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AUGUST 1961

Heating Piping & Air Conditioning

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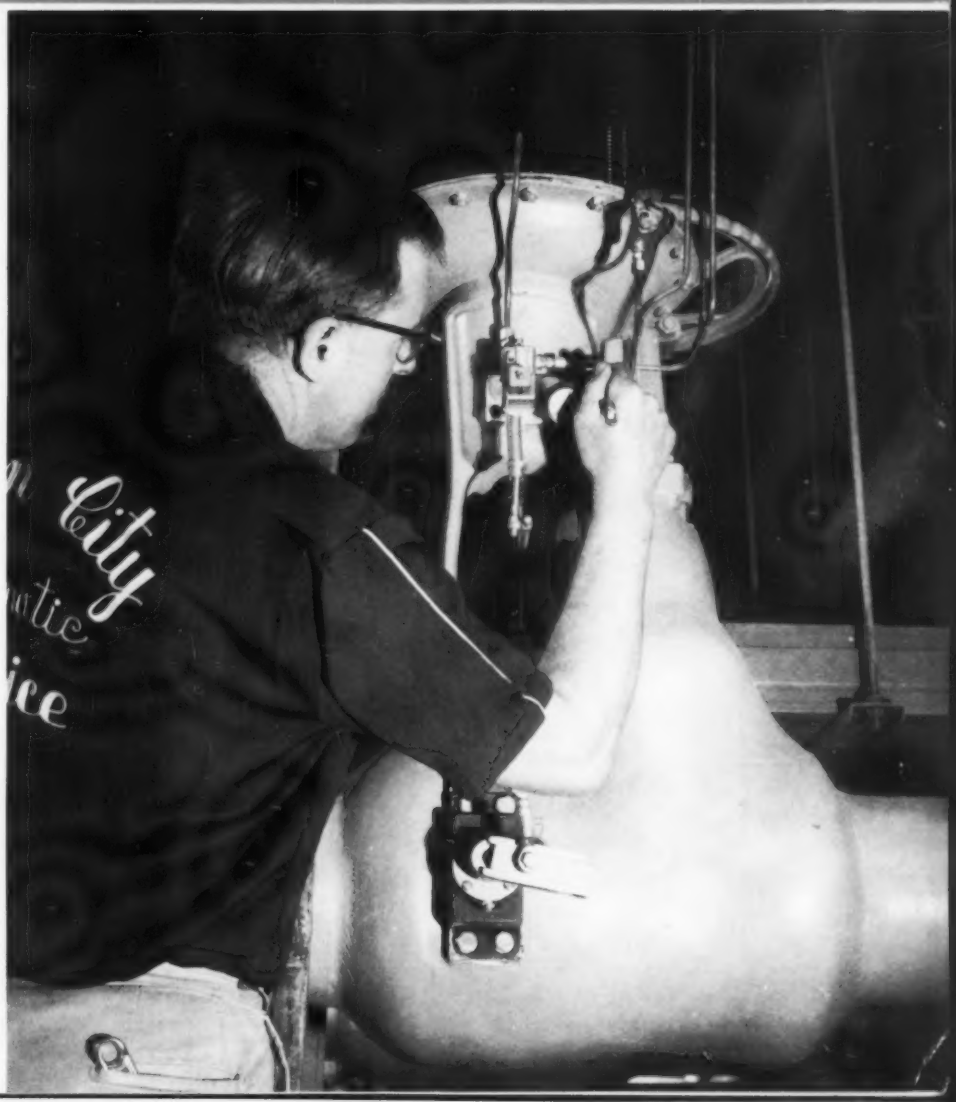

Spring St., L.A. *like* Wall St., N.Y.C.

knows the soundest investment in valves

New headquarters of UNITED CALIFORNIA BANK
Los Angeles

Again, JENKINS VALVES are the bankers' choice

Taller, perhaps, but there's no *finer* bank building in New York than the new Head Office of United California Bank on Spring Street in Los Angeles' financial area. Headquarters for 122 offices in California, this 370,000 sq. ft. building is an outstanding example of the excitingly modern architecture and superb engineering and construction which draws many building experts to Southern California for a "look-see."

There's an expected "California difference" in the design and decor of this bank. But a significant fact is that, like so many of the great bank buildings in New York and other cities, the valves that control the piping systems bear the same *"Diamond and Signature"* trademark.

Obviously, California bankers and their architects and engineers agree with their contemporaries everywhere about the soundest investment in valves. To assure a building-lifetime of trouble-free, economical valve service, they call for JENKINS.

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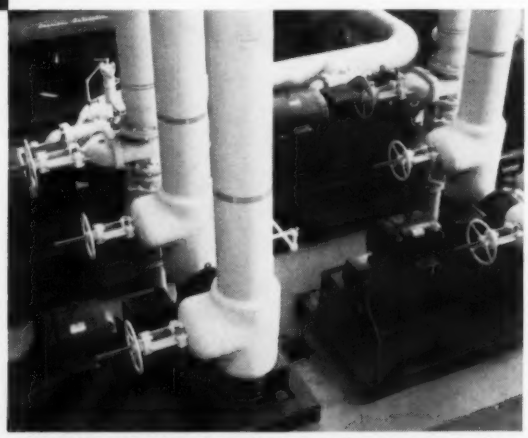

Jenkins Valves control all service lines in the plumbing, heating and air conditioning system

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Seamless and welded tubular products, solid extrusions, seamless welding fittings and forged steel flanges—in carbon, alloy and stainless steels and special metals

Again RCA uses Atmos-Pak! & gets an Extra Dividend

For convenience, efficiency, economy and attractiveness, Atmos-Pak heating and cooling was again specified by RCA. This time for the new Palm Beach Gardens, Fla., electronic computer plant. RCA got an extra dividend! While actual construction was underway, it became necessary to add additional facilities. Because of the flexibility of roof-mounted Atmos-Pak, adding new units was quick and easy... with no extra costs except for units themselves and for wiring. Architect and engineer, occupant and owner, builder and contractor all get an extra dividend from Atmos-Pak. This factory assembled, pre-fabricated heating and/or cooling system can be delivered and in operation the same day! Write for information and engineering data.

Architect: Malcolm B. Wells, Merchantville, N. J. • Assoc. Consulting Engineer: Arthur Parker Assoc.

In right foreground, the Administration Building, RCA plant, Palm Beach Gardens, Fla., with three Atmos-Pak units under simulated hip roof. Immediately behind, the Restaurant, two units. Behind that the Engineering Building, simulated hip roof, ten units. In the rear, Warehouse, 19 units, and left, Manufacturing, 24 units. Total capacity 1000 tons.

the atmos-pak

Patent No. 2886955

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ATMOS-PAK, Inc., 88 North Highland Avenue, Ossining, N.Y.

Pioneer, Designer, and Manufacturer of Roof-Mounted Heating and/or Cooling Systems

Heating, Piping & Air Conditioning

FOR CONSULTING ENGINEERS, MECHANICAL (HEATING, PIPING, AND AIR CONDITIONING) CONTRACTORS, ENGINEERS WITH PLANTS AND BIG BUILDINGS

VOL. 33, NO. 8 AUGUST 1961

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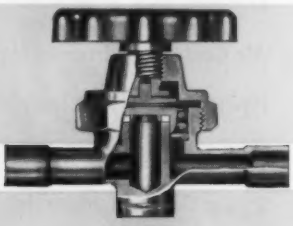

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Integral and Flanged Connections

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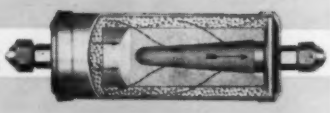

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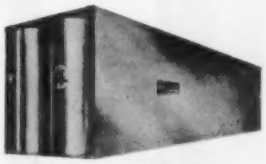
Fan Noise CONTROLLED in Air Handling Systems QUICKLY & ACCURATELY in less than 5 minutes!

Recognition that noise generated by fans in air handling systems could be predicted and controlled has led to a series of developments in both the "calculations" and also the necessary noise control equipment.

Guesstimating has now been eliminated by the general acceptance of these 4 important steps, functions and/or considerations: (1) that the total fan noise and its spectrum is substantially per the ASHRAE GUIDE dated 1957 or later (2) that we now have workable data covering the natural noise reduction due to ductwork, elbows, splits, distances, end reflections, room absorptions, etc. (3) that we have NC and NCA criteria for each of the 8 octave bands for most types of areas and we can now specify what is desired, and more important, by using an octave band analyzer, it can be readily determined whether the specified criteria has or has not been met (4) the development of prefabricated noise reduction units (noise traps, sound traps, etc) which have been properly factory tested and rated so they can be used with the method mentioned above.

"Short Form" Makes Selection Easy

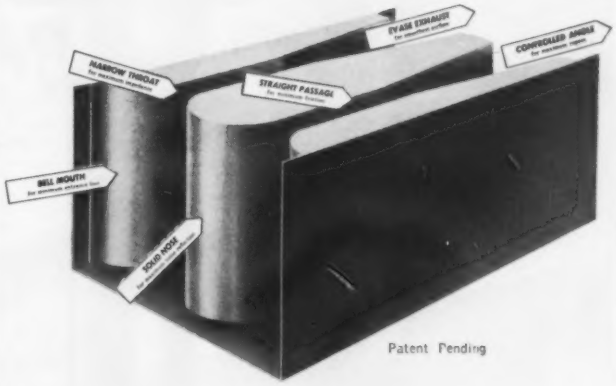
Since that time, because of the progress made in the design of Quiet-DUCT Silencers, and the wide acceptance of newly developed techniques mentioned above, the "Short Form" has been developed to make the selection of unit silencers for air handling systems an easy matter.



QUIET-DUCT SILENCERS
4 STANDARD MODELS
4 LOW PRESSURE MODELS
44 UNIT SIZES
90 MULTIPLE UNIT SIZES

CONIC-FLOW SILENCERS
18 STANDARD UNIT SIZES

"Cut-Away" View Reveals New Design of "Packaged" Quiet-DUCT Silencers.

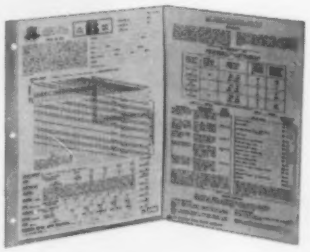


Patent Pending

Over ten years of experience in controlling noise in air handling systems has resulted in this new, basic design for all "packaged" silencers manufactured by our company. Design requirements include: *Bell Mouth Entrance* for minimum air pressure loss; *Solid Nose* for maximum noise reflection; *Narrow Throat* for maximum noise impedance. *Straight Passages* provide smoother airflow with more silencing and less regenerated noise. *Less Pressure Drop* is achieved by the diverging design of the evasè exhaust, keeping turbulence at a minimum and attaining maximum pressure regain.

The "SHORT FORM" consists of a small binder containing a pad of 25 reproducible work sheets. Only one such sheet is necessary to quickly and accurately resolve each noise problem and determine whether silencers are required, and if so, the silencer model needed to provide the Noise Reduction required for the problem. The "SHORT FORM" gives the Noise Reduction required in the 3rd octave band (in decibels) based on the data and procedures published in the ASHRAE GUIDE & DATA BOOK. Many field experiences have demonstrated that 3rd band calculations, by themselves, are a reliable index to silencing requirements as related to air handling systems. Because of the inherent characteristics of the "packaged" Quiet-DUCT silencers — if silencing is required in the 3rd Band, and the unit silencer is selected based on this criteria, more than enough noise reduction will be provided for all other bands as well.

The "SHORT FORM" is available through our representatives or write direct.



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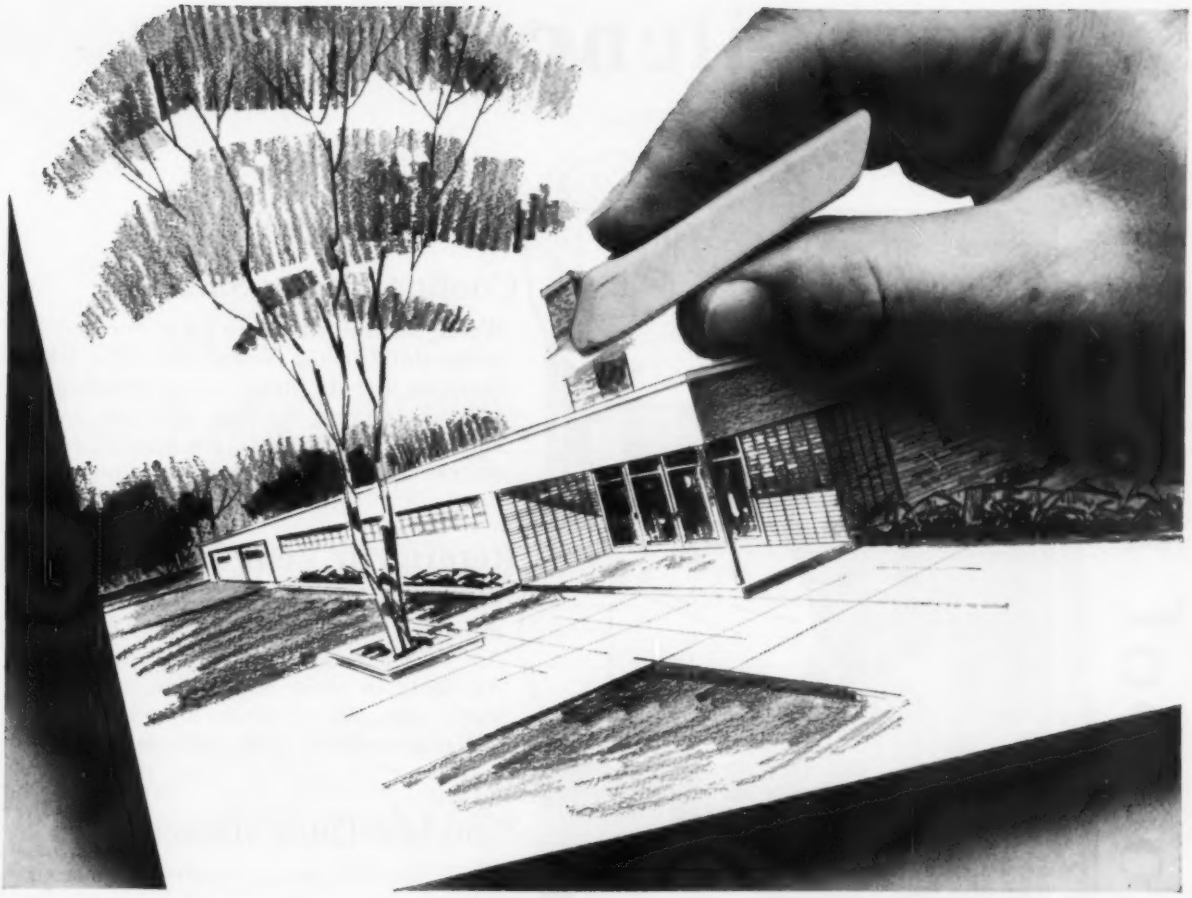
Our dealers are assistant empire-builders, but they're listed in The Yellow Pages under TOOLS. Talk to them about *your* empire. (Among other things, they'll tell you why we have red tips.) **Ramset®**

291-H Winchester Ave., New Haven 4, Conn. WINCHESTER-WESTERN DIVISION **Olin**



FORGET THE CHIMNEY WHEN YOU SPECIFY A WEIL-McLAIN TYPE "J" GAS BOILER

The Weil-McLain Type "J" Cast Iron Gas Boiler does not need a high chimney which breaks up the smooth sweep and flow of modern architecture... nor is a draft fan necessary. It conforms to A.G.A. venting requirements... products of combustion can be expelled with only a 5 foot vent riser beyond the draft hood openings. Where building conditions require a longer vent, design and sizing data are available from Weil-McLain.

Other highlights of "J" Boiler design

1. A.G.A. approved efficiency of 80%.
2. Compact design saves boiler-room space—up to 50%.
3. A.G.A. approved for all gases.
4. Electronic controls and pre-wired control panels engineered as part of unit.
5. No refractories, motors, fans, tubes or water treatment.
6. Can be assembled at any stage of building construction.
7. 33 sizes in 500 gross sq. ft. increments permit close sizing.

Send for Bulletin C-297. For oil boiler information see Engineers' Product File or Sweet's Architectural File.

Type "J" Gas Boiler
Net I=B=R Ratings, steam and water, 360,100—3,354,000 BTU/hr.

WEIL-McLAIN CAST IRON BOILERS

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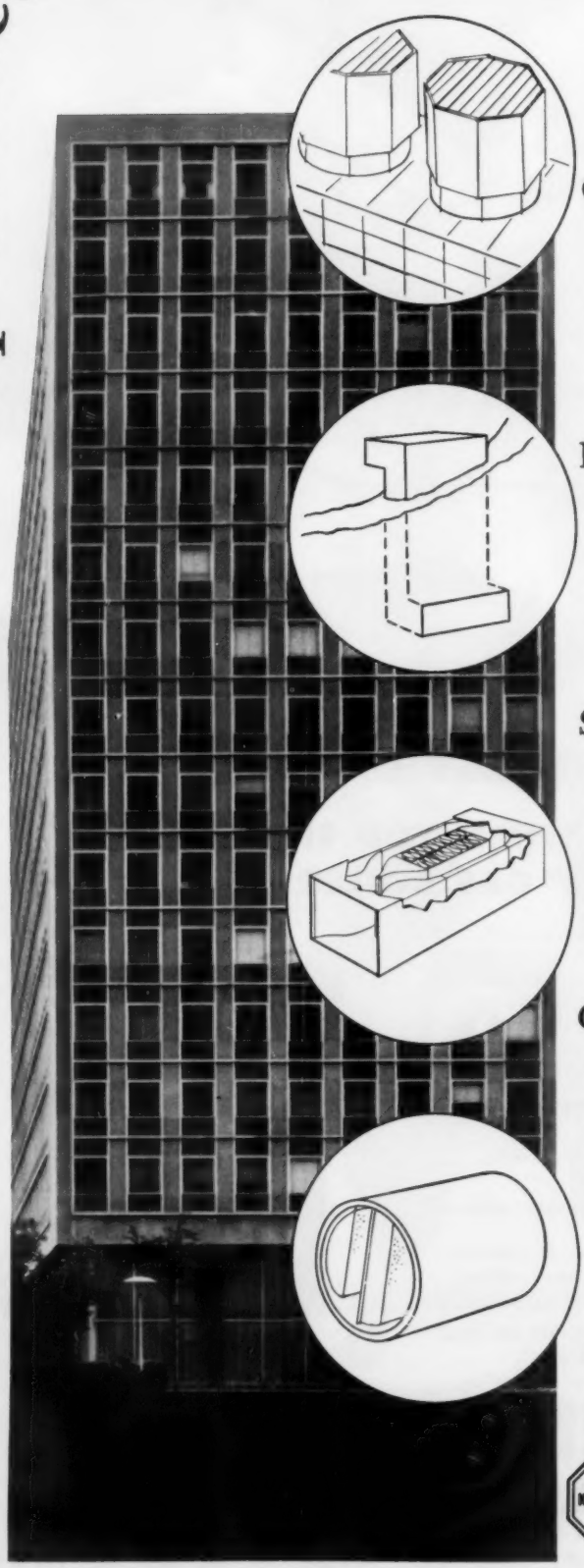
From basement to roof top...Aircoustat® silences noise



Cooling Tower Silencers

Water, fan and air noises are eliminated by Aircoustat Cooling Tower Silencers. Basic elements include intake sound proofing as well as exhaust mufflers. Because every building's requirements are special, every system is individually designed.

Return Air Vent Silencers

Block voices and other noises transmitted through transfer grills. Aircoustat Return Air Vent Silencers trap sound but not air. Available in three configurations and six stock sizes. Adaptable to a variety of installations—doors, walls, ceilings, etc.

Standard Duct Silencers

These low-cost, pre-engineered units assure a lifetime of trouble-free, maintenance-free service. Pre-determined values eliminate guesswork, *guarantee* the right attenuation. More than 60 stock models, fabricated in six lengths, available "off the shelf." No local job adjustments, no fabrication.

Circular Silencers

High velocity air system sounds need not be excessive if proper consideration is given to attenuation. An Aircoustat Circular Silencer adjacent to the fan does the job. Designed especially for higher pressure systems as well as for standard cylindrical ductwork. A full range of standard sizes available.

Selecting performance guaranteed AIRCOUSTAT *units is quick and accurate. We'll be pleased to supply you with complete technical and ordering information on any or all silencers in the line. Write:* KOPPERS COMPANY, INC., *3308 Scott Street, Baltimore 3, Maryland.*

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SOUND CONTROL

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LETTER FROM THE EDITOR

August 1961

Dear Reader:

As you would expect, the new First National Bank Building in Minneapolis is completely air conditioned. How it is done, however, may not be what you would expect. The article about this interesting job is featured on the cover and begins on page 93. This is the first new skyscraper to be built in Minneapolis in the last 25 years and of course the inside conditions had to be faultless. Control of this environment was a major factor in the design, and reports indicate the systems are operating as designed and installed. Water from 500 ft wells is used for condensing purposes.

George Chadwick is a firm believer in reducing waste in boiler plants. He has applied his basic fundamentals to many installations and has always been able to show where savings could be made. His article on page 98 illustrates how checking small losses can yield big savings in boiler plants, and I suggest you consider some of these tips in the design and operation of your heating and piping systems too.

The world's first all-centrifugal air source heat pump system has been installed in Mocksville, North Carolina, and I know you will find the details of this job to be of interest. Bob Werden, author of the article (page 102), explains how the system uses process and outside air heat during the winter and how the system generates chilled water for summer cooling in this large factory and warehouse.

Do you agree that predicting natural vibration frequencies in complicated piping systems has always been somewhat of a problem, and generally an unsolved one? This was the basis for a study conducted at the U. S. Naval Postgraduate School to check the fundamental vibration theories as applied to piping systems. The authors of the article (page 105), W. E. McGarrah and John E. Brock, conclude that now you can predict the fundamental vibration frequency of piping systems.

After becoming acquainted with Dick Danks a couple of years ago, we asked him to prepare the article on page 110 so you could learn what he has done to get his maintenance program underway in his system of hospitals. I feel his approach and the results already achieved in educating maintenance men and stimulating them to become interested is certainly worthy of your consideration.

LETTER FROM THE EDITOR (Continued) --

I'm sure that I do not need to tell you that the selection of air cooled condensers for air conditioning applications depends upon a thorough knowledge of how and why they work. Of course this also applies to other components in the system, but I believe it is of greater importance in this case because of the relatively low specific heat of the air and the relatively low temperature differentials that are encountered. This, together with the increasing use of air as a direct cooling medium, has brought Bob Roberts to the point of writing the article on pages 113 to 119. I hope you will find his analysis to be interesting.

After reading the article on pages 123 and 124 illustrating several methods of heat recovery, I surely would like to hear your experiences as I know others would too.

To say that differences in altitude have an effect on the performance of heating and air conditioning equipment is not news to you, I'm sure, but can we always predict what this effect will be? The article on page 126 explores some of the factors involved, and it also serves as an introduction for an article to be published next month on the subject of high altitude psychrometric charts developed by Roger Haines of the consulting engineering firm of Bridgers & Paxton in Albuquerque.

When ground water is considered for industrial cooling, how can field tests determine the potential quantity and quality? John F. Hoffman answers this in his article on page 127 by describing the methods, equipment, and calculations that are generally used. This procedure should be followed to be sure the water supply is right for the anticipated needs.

Two more answers are given this month to the question, "How Can We Get Smooth Operation When Heating with High Pressure Steam?" on pages 87 to 90. Do you have a solution to this question?

The You'll Want to Know pages (39 to 44) contain several interesting news items about the industry and some short application stories which I feel will be worth your attention. Also, don't miss the Equipment Developments pages this month beginning on page 143.

Part 2 of this issue is another Trade Literature Supplement prepared for your convenience in obtaining copies of new bulletins with a minimum effort on your part.

Bob Roose

Editor

It's new and exclusive...

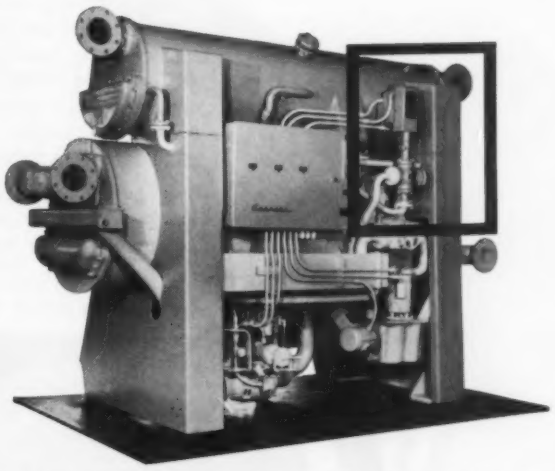
CARRIER SOLUTION CAPACITY CONTROL

with Automatic Absorption Refrigeration cuts operating costs to an all-time low!

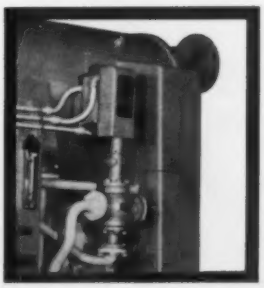
Through lower steam consumption per ton of refrigeration when working at partial load, Carrier Solution Capacity Control cuts operating costs. Since refrigeration equipment seldom works continuously at full load, the savings it effects can be substantial. With it, full advantage may be taken of the lowest possible steam rates. Results: Maximum economy and peak efficiency.

Two other advantages of Solution Capacity Control: (1) Steam pressure always remains constant. There's no need for manual or costly automatic steam control valves. (2) In addition to reducing steam consumption at partial loads, this Carrier development lowers the temperature of the condenser water leaving the machine and also eliminates bleeding of air into the condensate system. Results: Longer life, reduced water treatment requirements and few shutdowns.

Available for either electronic or pneumatic operation, Solution Capacity Control is now standard on all Carrier Automatic Absorption Liquid Chilling Packages. It can be installed with only minor adaptation at job-site on existing Carrier units. A Carrier representative will be glad to give you complete information about it. Write Carrier Air Conditioning Company, Syracuse 1, New York. In Canada: Carrier Air Conditioning Ltd., Toronto 14.



For air conditioning or process cooling, the Carrier Automatic Absorption Liquid Chiller uses low-pressure steam, high-temperature hot water or other hot liquids to produce refrigeration. Capacities: 50 to 1000 tons.

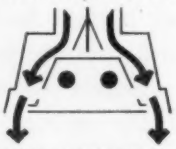


Solution Capacity Control System precisely controls machine output by reconcentrating only enough lithium bromide solution to handle the refrigeration load. When operating at partial capacity, the excess portion of full load solution is bypassed through the capacity control valve – positioned automatically in response to chilled water demands. Capacity control avoids all the additional heat loss which would accompany the unnecessary heating and cooling of the solution.

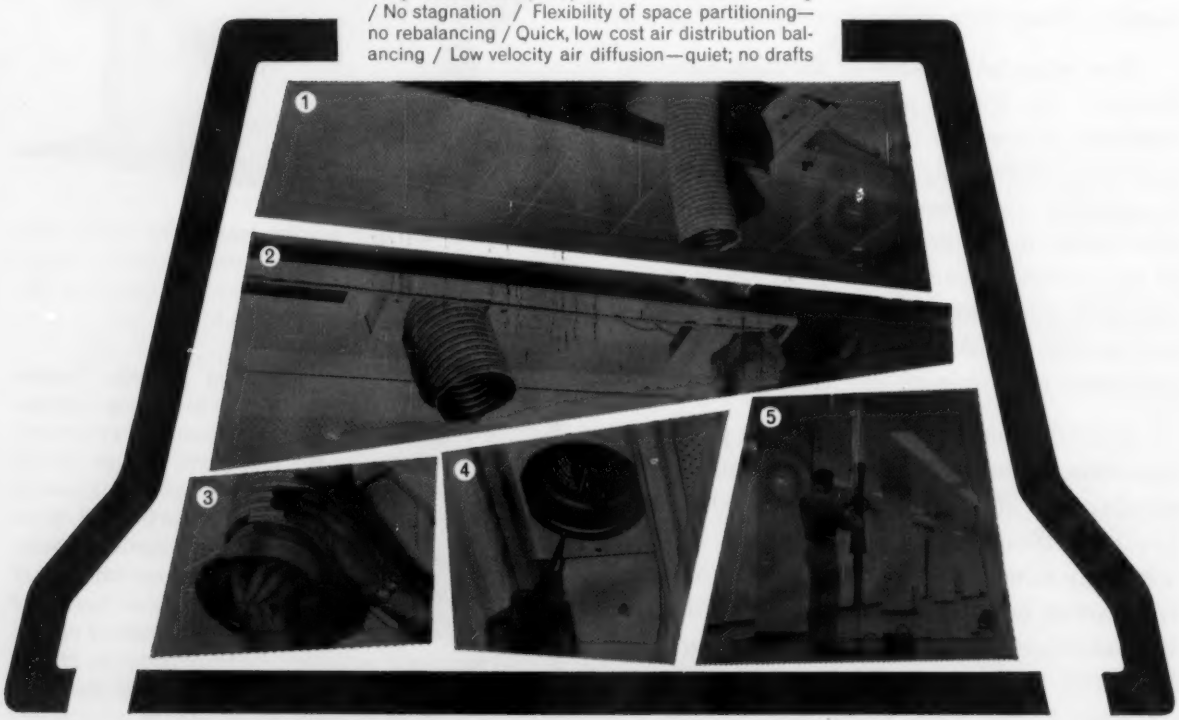
Carrier Air Conditioning Company

LOWEST TOTAL COST

The Multi-Vent system's unique design and engineering enables you to gain the advantages of combining light and air distribution at lowest cost. This applies to initial installation, operation, and maintenance costs, whether the totals be compared with separate systems for providing lighting and air conditioning, or for other combination systems. Take maintenance costs, for instance—by diffusing the air straight down at low velocity, *Multi-Vent prevents ceiling or wall smudging* and thereby *reduces cleaning and redecorating costs.* And, ... Here's A Union Approved Procedure that Helps Keep *Installation* Costs Low. **1.** Flexible tubing dropped through fixture opening in completed ceiling. **2.** Troffer installed—tubing extending through 5" knockout **3.** Air valve assembly conveniently attached to the tubing from below **4.** Completed ceiling without access through ceiling **5.** Exclusive "Venturi" simplifies accurate balancing.



THE MULTI-VENT SYSTEM GIVES YOU THESE OTHER IMPORTANT BENEFITS More light output / Longer ballast life / Superior room air conditioning / No stagnation / Flexibility of space partitioning—no rebalancing / Quick, low cost air distribution balancing / Low velocity air diffusion—quiet; no drafts



THE MULTI-VENT SYSTEM OF LIGHTING AND AIR DIFFUSION

THIS SYSTEM IS AVAILABLE FROM THE FOLLOWING MANUFACTURERS:

***COLUMBIA**, Columbia Lighting, Spokane, Washington*

***MILLER**, The Miller Co., Meriden, Connecticut*

***PYLE-NATIONAL**, The Pyle-National Company, 1334 N. Kostner Avenue, Chicago 51, Illinois*

***SYLVANIA**, Sylvania Electric Products, Inc., Wheeling, West Virginia*

Announcing the newest addition to the Amprobe family

NOW TEST VOLTS AMPS AND OHMS

FOR ONLY $29.85

You read right. The AMPROBE JR. *Testmaster Kit* lets you *read* voltage on a calibrated scale (not just an indication), measure amps *without* interrupting service *and* test for resistance...at half the price you'd expect to pay for a tool of similar versatility

The Kit consists of the AMPROBE JR., an ohmmeter attachment, test leads, a leather carrying case and the AMPROBE *Energizer* ("splits" double-conductor cords for direct readings at outlets, or boosts the sensitivity of the instrument 10X for readings on fractional h.p. motors).

Pick the range that best fits your job from six rugged, lightweight models: 0-25 to 0-100 amp; either 0-125/150 or 0-150/600 volts AC; 25 ohms mid-scale. For more details about this newest addition to the most-complete family of pocket-sized, snap-around test instruments in the world, see your Distributor or write for Catalog sheet AAD-1.

PYRAMID INSTRUMENT CORP., LYNBROOK, N. Y.

Canada: Atlas Radio Corp., 50 Wingold Ave., Toronto.

PPG Fiber Glass Pipe Insulation is slit lengthwise, slips easily on to pipe. Delaware Insulation Company installed 15,000 ft of PPG Pipe Insulation in the new Wilmington High School, reported excellent working characteristics.

"We can install PPG Fiber Glass Pipe Insulation 15% faster than other pipe insulating materials"

says Mr. Anthony Kotowski, foreman, Delaware Insulation Company, Wilmington, Delaware

"A good worker can insulate 200 feet of pipe in one work day. But with PPG Pipe Insulation, he can insulate 230 feet in the same amount of time," reports Mr. Kotowski. "This helps us maintain tight construction schedules and saves money, too!

"We like PPG Fiber Glass Pipe Insulation because it's flexible and workable. We bend it around pipe hangers, mold it to shape easily, smooth it, then fasten and bind it," continued Mr. Kotowski as he discussed the PPG installation in a Wilmington High School. "You can't do that with other insulations. They're too brittle, require cutting, and sometimes break when you're working with them.

"PPG Pipe Insulation is easy on the hands, and it's not attacked by rodents. Of all the insulations on the market, PPG gives the neatest, quickest job."

GET TOP RESULTS WITH PPG

Fast installation, excellent thermal insulation, long service life, low maintenance . . . all these advantages are yours with PPG Fiber Glass Pipe Insulation. It's available in a full range of sizes, with or without facing.

For full information, contact your nearest PPG Fiber Glass Sales Office, or write *Pittsburgh Plate Glass Company, Fiber Glass Division, One Gateway Center, Pittsburgh 22, Penna.*

FIBER PG GLASS

PITTSBURGH PLATE GLASS COMPANY

Sales Offices: Atlanta, Boston, Buffalo, Chicago, Cincinnati, Cleveland, Dallas, Detroit, Houston, Kansas City, Louisville, Los Angeles, Miami, Milwaukee, Minneapolis, New Orleans, New York, Philadelphia, Pittsburgh, San Francisco, St. Louis and Seattle

In The Lead With Ucon® Refrigerants

"Fustest with the mostest" is UCON IKE's history thus far, as witness the pioneering of the ring-top refrigerant cylinder, introduction of the handwheel cylinder valve, and instant cylinder deposit refunds . . . all important firsts in packaging and convenience.

And being in the lead is something UCON IKE and the friendly folks he represents, firmly intend to *continue*. When you *really* need something, *we'll deliver* — whether it be in packaging conveniences or helpful service.

Our promise: being on our toes to meet *your* every on-the-job refrigerant need.

For the most compact and *convenient* line of refrigerants . . . See your UCON Refrigerants wholesaler.

UCON Refrigerants are manufactured by
UNION CARBIDE CHEMICALS COMPANY — Division of Union Carbide Corporation
270 Park Avenue, New York 17, N. Y.

Exclusive Sales Agent to Air Conditioning and Refrigeration Wholesalers
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UCON is a registered trademark of Union Carbide Corporation

UNION CARBIDE product Ucon® refrigerants — exclusive sales agent ANSUL

Quiet...

WAGNER Polyphase Resilient Mounted Motors in ratings through 10 horsepower

Quiet, vibration-free performance is essential when motors are installed in areas where noise must be held to a minimum . . . in hospitals, churches, schools, office buildings, restaurants and similar locations where quiet is needed or wanted.

Such installations have created a need for larger polyphase motors that whisper while they work. Wagner has met this need by expanding its line of polyphase resilient mounted motors to include standard ratings through 10 hp.

You certainly have applications that call for a smooth running motor, cushioned by resilient mountings. To make sure they're quiet, specify Wagner Polyphase Resilient Mounted Motors. Only Wagner can provide an entire range of ratings through 10 hp.

Constant research and development have kept Wagner up front in electric motor design for more than 65 years . . . made the name Wagner one you can depend on in choosing electric motor drives.

Your nearby Wagner Sales Engineer can help you select the right motor to meet your requirements. There are Wagner branch offices in 32 principal cities.

Wagner Electric Corporation
6370 PLYMOUTH AVENUE, ST. LOUIS 33, MISSOURI

WM60-14

SLEEVE OR BALL BEARING

These motors are furnished with quiet running steel-backed babbitt-lined sleeve bearings of high load carrying capacity. Ball bearings can be supplied when desired.

CEILING, SIDEWALL OR HORIZONTAL MOUNTING

You can mount these motors on walls or ceilings by rotating the cradle base 90° or 180°. Motor stays dripproof.

NEOPRENE CUSHIONING RING

Annular mountings, of oil-resistant neoprene bonded to steel rings, cushion the motor in its cradle base to absorb the small amount of vibration that remains in the most carefully balanced motor.

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MOTOR HOTEL . . . . .

Fabulous

and
air conditioned with
311 McQuay individual
room Seasonmakers

McQuay INDIVIDUAL ROOM SEASONMAKERS

4 types, 220 to 1240 cfm
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MARRIOTT MOTOR HOTEL, DALLAS
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Consulting Engineer—Herman Blum
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McQuay Means Quality

The fabulous Marriott Motor Hotel of Dallas, Texas, was created to supply its many guests with all the luxury and comfort that gracious living can offer.

One important Marriott luxury feature is the individual room controlled air conditioning supplied by 311 McQuay Seasonmaker air conditioners which enable occupants to comfort condition their rooms to their personal desire.

Engineers, architects and contractors agree that McQuay Seasonmakers offer the flexibility, dependability, advanced design features and the economy that make them ideal for all hotel, motel, apartment or office installations. Contact your local McQuay representative for the complete Seasonmaker comfort conditioning story, or write McQuay, Inc., 1601 Broadway N. E., Minneapolis 13, Minnesota.

McQuay INC.

AIR CONDITIONING • HEATING • REFRIGERATION

MAKE THE SEASONS COME TO YOU

Cuts costs!

Honeywell's new V4034
FLUID POWER GAS VALVE

One powerhead handles any of the six body sizes from 1 to 3 inches. Buy only the few basic bodies and powerheads *you* need for complete flexibility with minimum inventory cost. Unique fluid power principle also assures less wear, long life. Available in ON-OFF and modulating versions. Has FM and FIA approval as a shut-off valve.

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Protectorelay*

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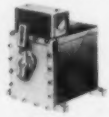
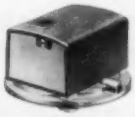

M931
Modutrol* Motor

V4021
Oil Valve


C645
Pressure Switch

V4004
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Gas Valve

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For details, write Minneapolis-Honeywell, Dept. AC-8-45, Minneapolis 8, Minn.

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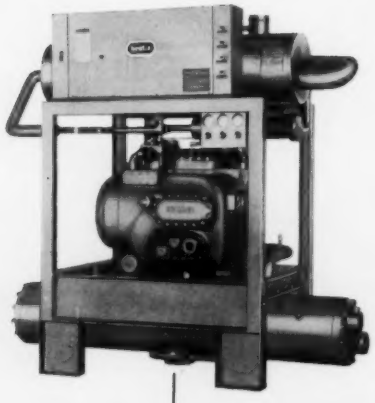
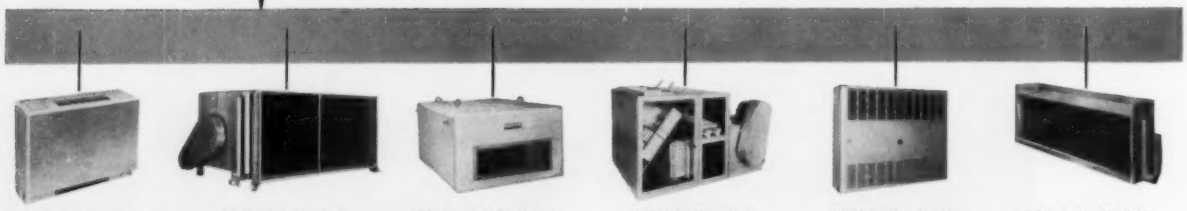


CHILLED WATER AIR CONDITIONING SYSTEMS

Development of packaged water chillers such as the Heat-X 'PC' units has done much to popularize the use of chilled water as a cooling medium for air conditioning. Reasons for the systems' popularity include: dual use of the same piping network for heating and cooling; economy in piping installation costs; simplified, more economical maintenance; variable capacities available within the framework of existing equipment; simpler, personalized temperature control; less stringent code requirements. Heat-X Package Chillers, used in conjunction with many Dunham-Bush units (as illustrated), offer a wide variety of chilled water air conditioning systems.



'CR' Fan-Coil Units. For motels, hotels, residences, institutions

'AH' Air Handling Units. For hospitals, office buildings, bowling alleys, manufacturing areas, supermarkets.

'CC' Comfort Conditioner Units. For office buildings, bowling alleys, light manufacturing, supermarkets, warehouses.

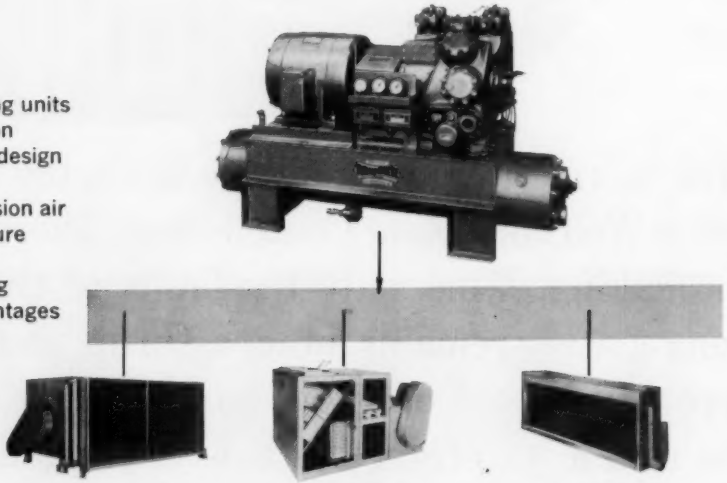
'MZ' Multi-Zone Units. For institutions, theaters, schools, plant offices.

'CHC' Cooling-Heating Wall Unit. For motels, small medical offices.

Water Coils (DX Coils where applicable). For laboratories, industrial air conditioning.

DIRECT EXPANSION AIR CONDITIONING SYSTEMS

Availability of easy-to-install air handling units and compactly constructed refrigeration condensing units such as the modern design Brunner Multi-Drive line has led to a change in thinking about direct expansion air conditioning systems. Wider temperature ranges are available, better control of relative humidity for various processing applications are some of the key advantages of direct expansion systems.



'AH' Air Handling Units. For hospitals, office buildings, bowling alleys, manufacturing areas, supermarkets.

'MZ' Multi-Zone Units. For institutions, theaters, schools, plant offices.

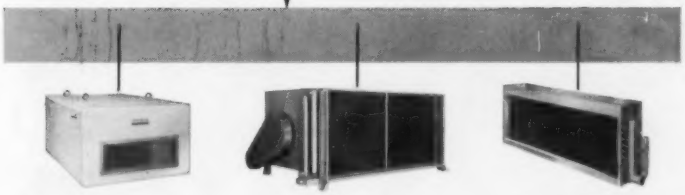
Water Coils (DX Coils where applicable). For laboratories, industrial air conditioning.

DUNHAM-BUSH

DUNHAM-BUSH Systems

DX AIR COOLED SYSTEMS

Reasons why the Dunham-Bush 'LSCU' (or 'LRCU') Remote Condensing Units have such popular appeal in the air conditioning picture today include: low initial investment, elimination of water supply and disposal problems through use of air cooled condensers, simplified maintenance, flexibility of condenser location and element-proofed construction (permitting outdoor installation with space saving and elimination of noise problems).



'CC' Comfort Conditioner Units. For office buildings, bowling alleys, light manufacturing, supermarkets, warehouses.

'AH' Air Handling Units. For hospitals, office buildings, bowling alleys, manufacturing areas, supermarkets.

Water Coils (DX Coils where applicable). For laboratories, industrial air conditioning.

No need to improvise or compromise when you specify DUNHAM-BUSH. There's a system designed to meet **your** specific needs!

And behind every Dunham-Bush product is the peace of mind reassurance represented by the company's half century of experience in the design and manufacture of quality air conditioning, refrigeration and heating products.

This reassurance underlies the increasing tendency among top consulting engineers to specify products by DUNHAM-BUSH—the company that's on the move . . . setting the pace in **modern** air conditioning.

On your next job, contact the DUNHAM-BUSH man . . . you'll find him helpful, experienced, reliable.

DUNHAM-BUSH, INC.

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Any way you look at it, Powell performance really pays off. Take "availability" for instance.

You'll find that Powell makes just about any type of valve you may need—for oil, water, gas, steam, air and corrosive fluid applications. The same holds true for virtually any temperature and pressure. What's more, you'll find Powell valves are available in industry's widest selection of bronze, iron, steel and special alloys—from aluminum to zirconium. (The fact is, Powell pioneered application of special alloys in valve design.)

In short, you'll find Powell performance also includes outstanding availability—of exactly the type valve you need. And, since Powell maintains large stocks both at the factory and key points across the country—you get exactly what you need, when you need it. For further information, contact your nearby Powell Valve distributor or write The Wm. Powell Co., Cincinnati 22, Ohio.

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Introducing

E-Z PLY

a new duct insulation from Baldwin-Ehret-Hill

Even in 1" thickness, new E-Z PLY can be readily handled for installation by one man.

Laboratory tests of sag and break strength and constant quality control checks demonstrate the greatly improved handleability of new E-Z PLY.

Exceeds requirements of U. S. Government specification HH-I-562 and HH-I-564.

Greatly improved rigidity and strength make new E-Z PLY duct insulation easier to handle and apply. Field trials indicate that labor costs, in many instances, can be noticeably reduced due to this improvement which results from a major change in manufacturing process.

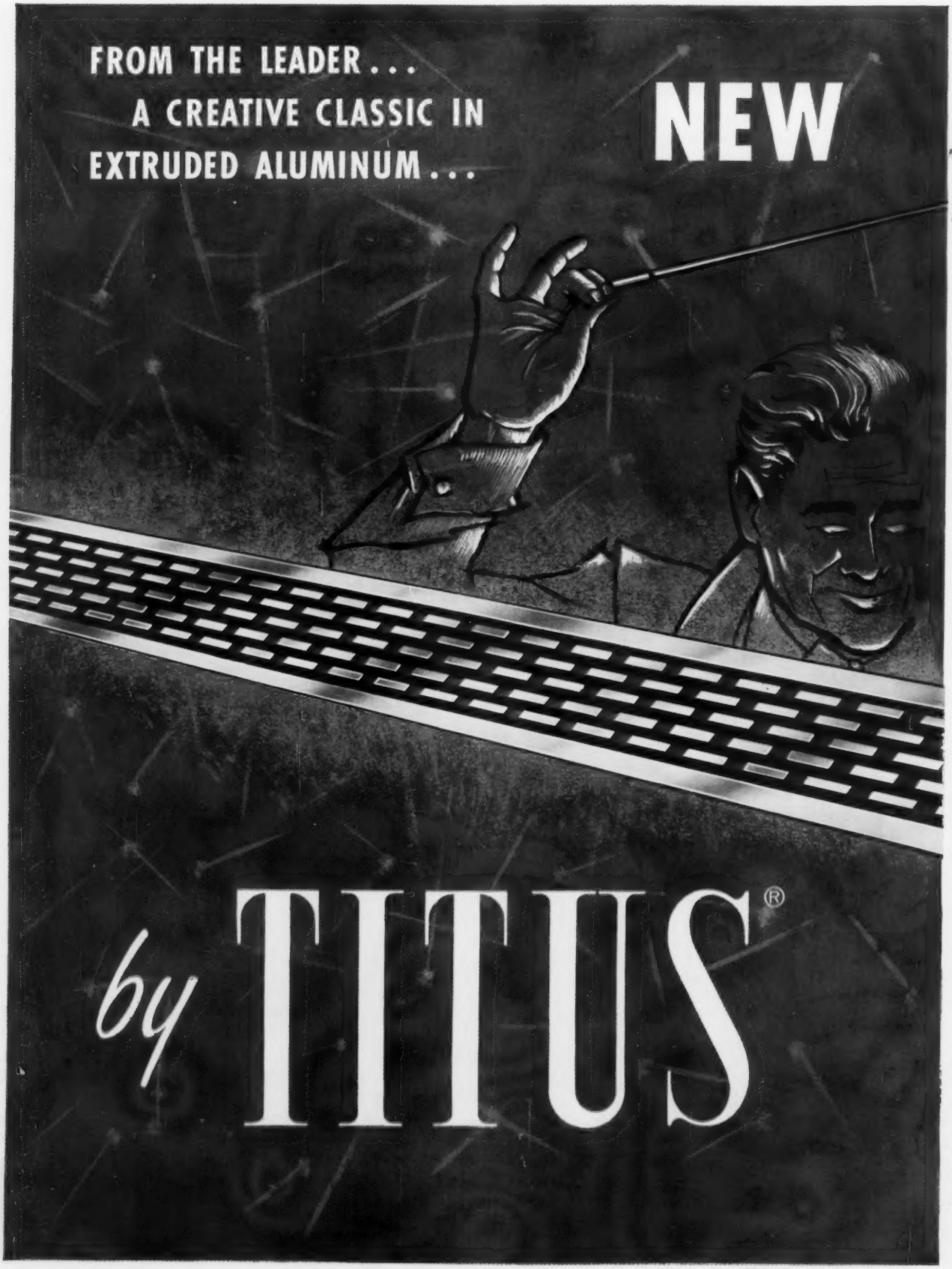
New Baldwin-Ehret-Hill E-Z PLY duct insulation is carefully manufactured of fine, long spun wool mineral fibers. It is easily cut or contoured on the job for application to all rectangular ducts, no matter how complicated. E-Z PLY is extremely effective as a thermal insulation up to 450 F., and provides the user with a noise reduction coefficient of .80 when used as a duct liner.

New E-Z PLY is manufactured plain, coated with neoprene, or faced with foil, foil scrim vapor barrier, and asphalt coated paper vapor barrier, and in 1", 1½" and 2" thicknesses.

For complete product and sample information and the name of your nearest qualified Baldwin-Ehret-Hill contractor write: Department 51, Baldwin-Ehret-Hill, Inc., Trenton 2, New Jersey.

BALDWIN-EHRET-HILL, INC. manufactures a complete line of duct, pipe and block insulations suited for temperatures from near absolute Zero to 2000 F.

B E H
BALDWIN-EHRET-HILL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EXTRUDED ALUMINUM . . .
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Sharp clear notes of vibrant extruded aluminum—highlighted against a recessed background of anodized black. Available in *endless patterns* to harmonize with, or accent, any architectural motif. That's superb new Titus Staccato Line . . . with *design so decidedly different IT GIVES A STARTLING NEW DIMENSION TO THE LINEAR CONCEPT!*

And here's air diffusion efficiency to match the breathtaking beauty! Staccato Line is *perfect for in-line use on sidewall or ceiling* . . . for heating, cooling or ventilating.

Available in a wide variety of extruded aluminum border styles. Furnished in many standard widths, in any length.

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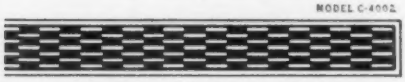
MODEL C-4001

MODEL C-4000

Staccato Line opens a vast new world of linear design freedom to architects and

MODEL C-4002



engineers. Select from an unlimited number of core patterns and border styles to

MODEL C-4003

develop your own individuality of design . . . or match any motif.

TITUS MFG. CORP. WATERLOO, IOWA

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MARLO *fills new hospitals' prescription for healthful, year-round comfort conditioning*

To help patients recover faster and staff members work more efficiently, two new hospitals in Georgia have been equipped with year-round air conditioning systems. They are the Wayne County Hospital at Jesup and the Decatur Memorial Hospital at Bainbridge.

In both cases, Marlo air conditioning products were selected to provide winter heating and summer cooling in these modern buildings. A total of 244 individual pieces of Marlo equipment were installed, including 212 Seazonaire remote room units, two central station units, 12 unit heaters and 18 coils.

With Marlo's versatile line of air conditioning and heat transfer products, systems can be tailored to the exact needs of buildings of all types—commercial, industrial, institutional, multiple-residence. For complete information, contact the Marlo representative in your area.

MARLO coil co.

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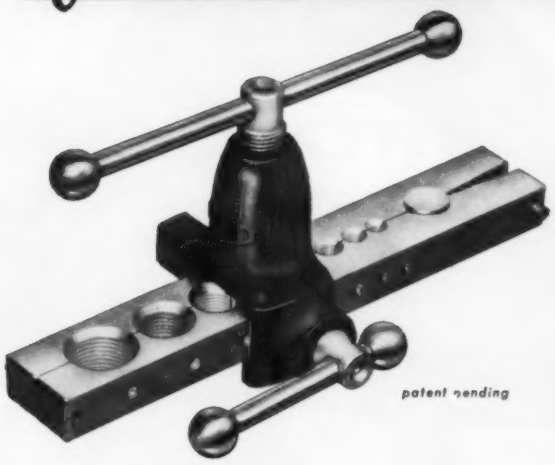
New! REED TUBING TOOLS



• REED #F-8 FLARING TOOL

This is a "sweet-working" tool for fast, accurate flaring of copper, brass and aluminum tubing. Flares tubing in 8 sizes, from 3/16" to 7/8" O.D.

Spring loaded plunger automatically centers unit on selected size.

•

Grooved die bar openings grip without distortion.

•

Die bar is solidly clamped at center line of tubing.

•

Hardened, high carbon steel flaring cone is centered above tubing to assure a perfectly shaped flare for a tight joint.

•

Special lug for clamping in vise.

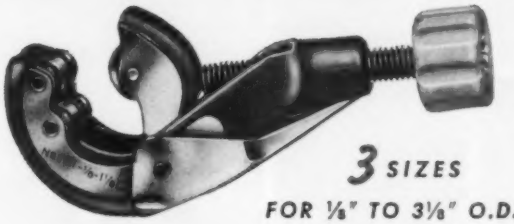
•

Ductile iron body is lighter, stronger because of closed frame design.

•

Handles provide full leverage for fast easy work; are spring loaded to "stay put."

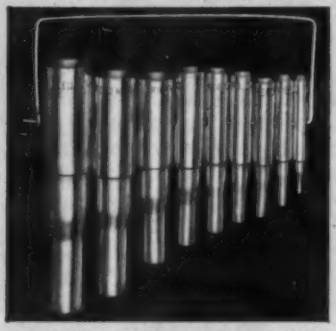
EACH tool in Reed's complete tubing line has exclusive design features which deliver time and money-saving performance on every tubing job. Whether you work with tubing tools or meet the payroll for men who do . . . you'll like Reed!



3 SIZES
FOR 1/8" TO 3 1/8" O.D.

• REED TUBING CUTTERS

These favorite Reed Cutters have been further improved by the addition of flange grooves in the rollers which let you cut closer to the end of the flared tubing. Further, the TC1 and TC2 now carry a replacement cutter wheel and pin in the aluminum handle. All other proved features are retained. Ultra thin alloy wheels cut easily without distorting the tubing. Pins have full bearing surfaces to assure perfect wheel alignment and straight cuts. Because the cutting wheel is in the movable arm, the tool is easier to position on the pipe. The wheel is always in plain sight for lining up with the cut-off mark. The TC1 and TC2 feature a genuine reamer, hardened and ground with rake and clearance to CUT rather than scrape the burr.

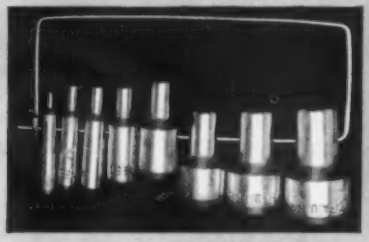


• REED SWAGING TOOLS

These handy tools eliminate extra couplings in joining same-size tubing. A few hammer taps form a perfect female coupling end. Precision machined, hardened, polished and cadmium plated. Drilled for safety pin carrying. Nine sizes for tubing from 1/8" to 3/8" O.D.

• REED BENDING SPRINGS

Slip the tubing into the right size spring and bend any desired radius without distorting or kinking the tubing. Six sizes for tubing from 3/16" to 1/4" O.D. Cadmium plated for easy release.

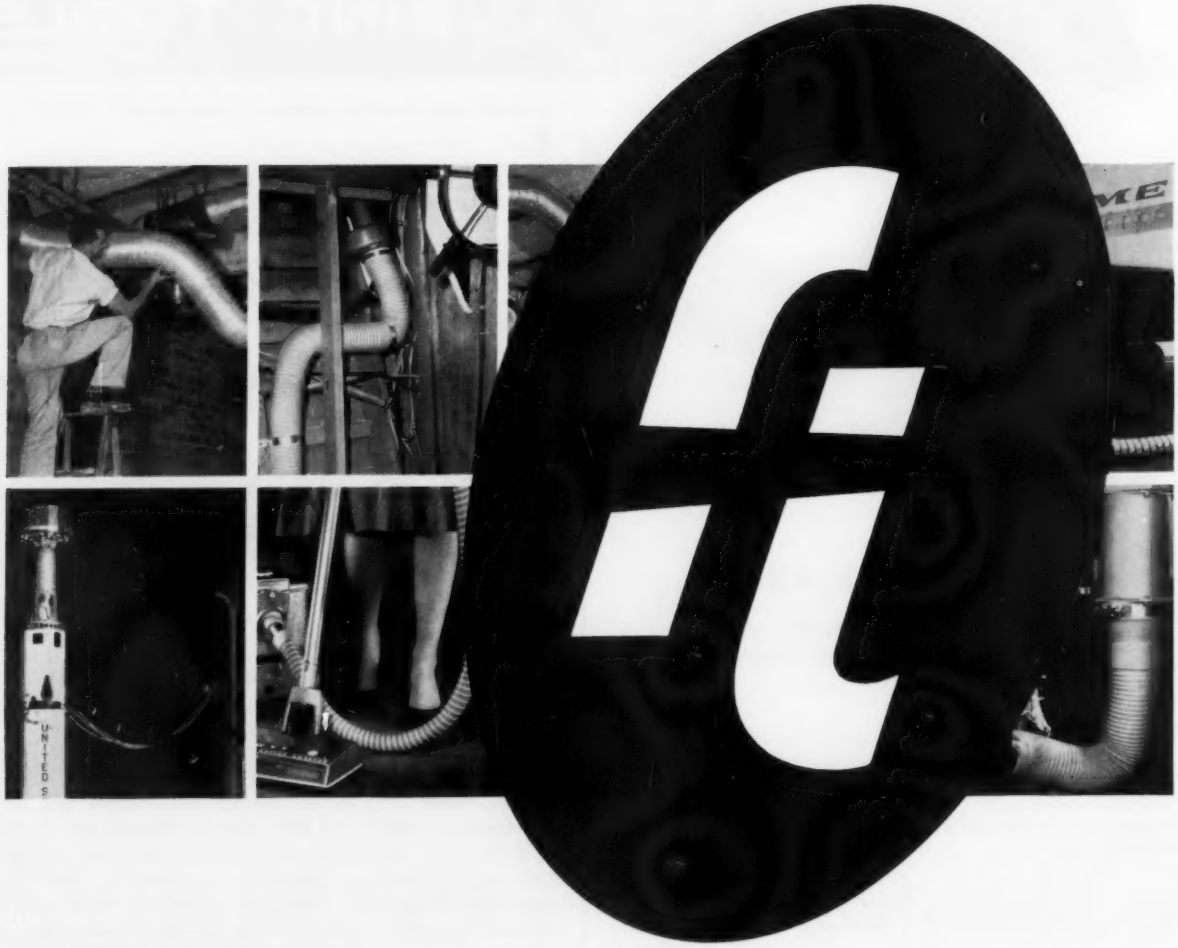


• REED HAMMER-TYPE FLARING TOOLS

Hardened, polished and cadmium plated, these lighter, easy-drive tools form perfect flared ends quickly and at low cost. Twelve sizes for tubing from 3/16" to 2 1/8" O.D. Available singly or in sets. Drilled for safety "pin" carrying.

See these new Reed Tubing Tools at your Supply House. BUY them to save time and money on tubing jobs.

REED MANUFACTURING COMPANY
Erie, Pennsylvania



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the people say...

When we designed this unique trade-mark for our line of nonmetallic tubes and ducts, we wanted to find out what sort of image it projects. So we showed it to people all over the country — people who know Flexible Tubing.

"It says Flexible Tubing is fast-growing, dynamic," was the way someone put it. "It says you're a research-oriented company," another commented.

Still others said: "your new trade-mark gives you a years-ahead look" . . . "tells me that Flexible Tubing is a company that's really going places" . . . "says you're keeping pace with age of Space."

"This is you," the people say about our new trade-mark. You'll find it now — big and bold! — on Flexible Tubing products made for original equipment, plant maintenance, air conditioning distribution systems, swimming pool vacuum cleaners, home laundry venting, aircraft and missiles.

Write today for Catalog 10-19. It describes the wide range of Flexible Tubing products available for your use.

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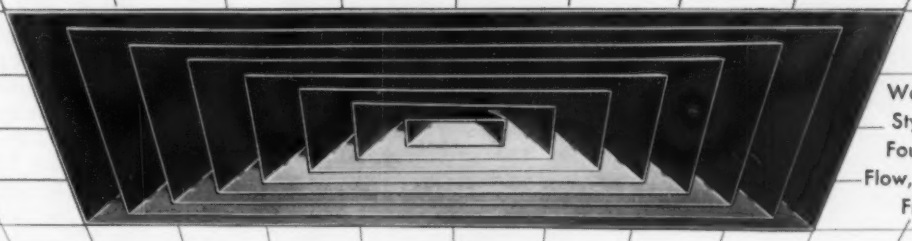
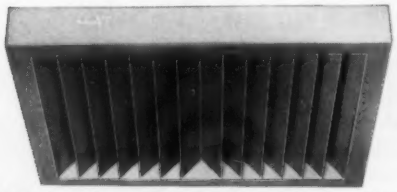


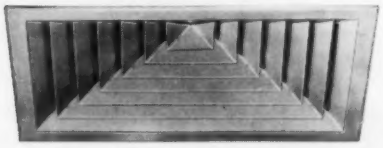
Waterloo Style DE Four Way Flow, Snap-in Frame

SQUARE and RECTANGULAR DESIGNS

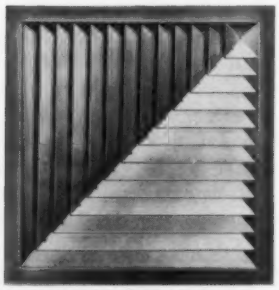
Waterloo Style DM One Way Flow Bevelled Frame



Waterloo Style DD Two Way Opposite Flow Drop Collar Frame



Waterloo Style DF Three Way Flow Flange Frame



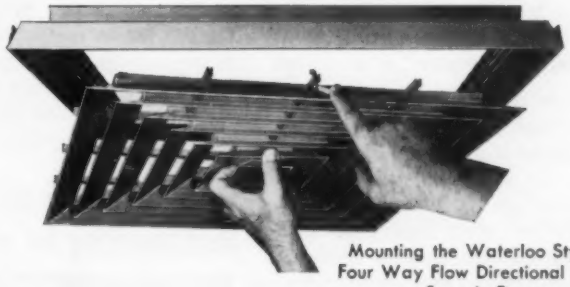
Waterloo Style DL Two Way Corner Flow Lay-on Frame

★ **EASIEST TO INSTALL**

★ **ONE-THIRD THE USUAL WEIGHT**
because of aluminum construction

★ **LONG-LASTING**
All extruded aluminum

★ **5 FRAME STYLES • 14 CORE PATTERNS**
All cores removable and interchangeable



Mounting the Waterloo Style DE Four Way Flow Directional Diffuser Snap-in Frame

DESIGNED BY WATERLOO
... pioneer in development of air diffusion equipment in EXTRUDED ALUMINUM

PERFORMANCE PROVED BY ANEMOSTAT
in the finest laboratories in the air conditioning industry

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WATERLOO REGISTER COMPANY, INC.

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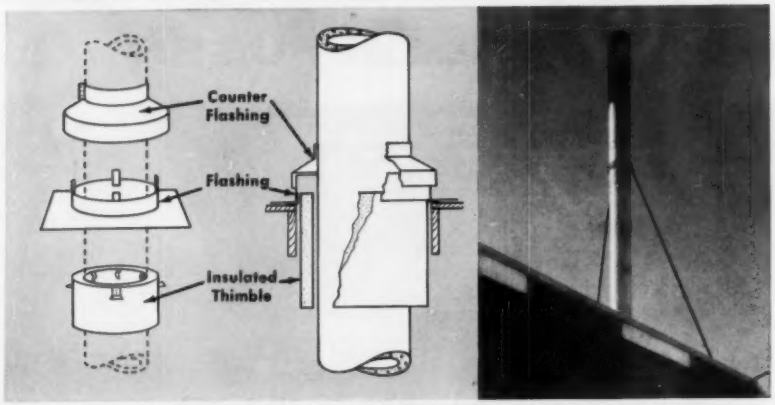
WR-124

FLINTKOTE® **VAN-PACKER®** Refractory Industrial Stacks

Solving Industrial Stack Problems

New insulated thimble simplifies the design of Van-Packer stack installation



Details of flashing assembly for Underwriters' Laboratories listed installation of Van-Packer Model HT Industrial Stack. Insulated thimble installs at zero-inches clearance to combustibles at roof opening. In sizes for 8 Van-Packer diameters.

Underwriters' Laboratories, Inc. ® INSPECTED Van-Packer Model HT Smokestack

A new insulated thimble and new flashing and counter flashing for Van-Packer factory-built refractory industrial stacks now let you design indoor installations with far less clearance to combustibles than previously required at the roof for a UL-listed installation.

The new components have earned a new Underwriters' Laboratories listing for the Van-Packer Model HT stack — the only UL-listed stack for commercial and industrial incinerators, boilers and furnaces. The insulated thimble installs at zero-inches clearance to combustibles, reducing actual clearance between the stack section and combustible roof from the 18" previously required by Underwriters' Laboratories to 3 inches. In non-combustible construction the thimble is not required because only a 4" clearance is necessary.

The new insulated thimble, flashing and counter flashing are available in appropriate sizes for each of the eight inner diameters in which the Van-Packer stack is offered: 10, 12, 15, 18, 21, 24, 30 and 36 inches. The new components may also be used with the Van-Packer Model BF Stack (not UL-listed). Both models are factory-built in 3-foot cylindrical refractory sections encased in aluminized steel. They can be installed inside or outside on concrete or brick pier foundations, or they can be floor-supported, wall-supported, or superimposed directly on the incinerator or boiler. Van-Packer stacks cost about the same as steel stacks for comparable applications, yet outlast steel an average of three times. The stack provides high draft and requires no painting.

Van-Packer stack section makes ideal breeching for any stack

There's no need to design special breechings for Van-Packer Industrial Stack installations — or for use with any other type of stack. In those cases where the stack is not superimposed directly on the boiler or incinerator, simply specify that the breeching is to be made with a Van-Packer stack section.

Van-Packer Model HT tee sections have a refractory projection for the breeching connection, with the opening equal to the inner diameter of the stack. A Van-Packer straight section with equal I.D. is easily joined to the projection to complete the breeching. The stack and breeching withstand temperatures up to 1800°F, or up to 2000°F for occasional brief periods of forced firing. Breechings for other Van-Packer stack models may be similarly made.

For full data on Van-Packer Stacks, write for Bulletin IS-49.

For residential use, specify the Van-Packer all-fuel chimney

Here's a low-cost, factory-built tile lined residential chimney that's safe and attractive. Specify either metal or asbestos-cement housing with embossed brick design. Choice of four non-fade brick colors: red, white, buff and gray. Factory-built 2-foot flue sections have 5/8-inch fire clay tile liner, 3-inch vermiculite-concrete insulating wall, and asbestos-cement outer jacket. Van-Packer chimney is UL-listed for all fuels, is safe for incinerators. Write for Bulletin RS-1.

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Fandaire's circular design eliminates return bends and allows a true counterflow arrangement – coolest gases meeting the coolest air. Cool air is drawn in from all sides, not off the hot roof . . . hot air is expelled up and out. The entire unit can be positioned where needed, without guy wires or extra bracing. Piping and installation savings can be considerable.

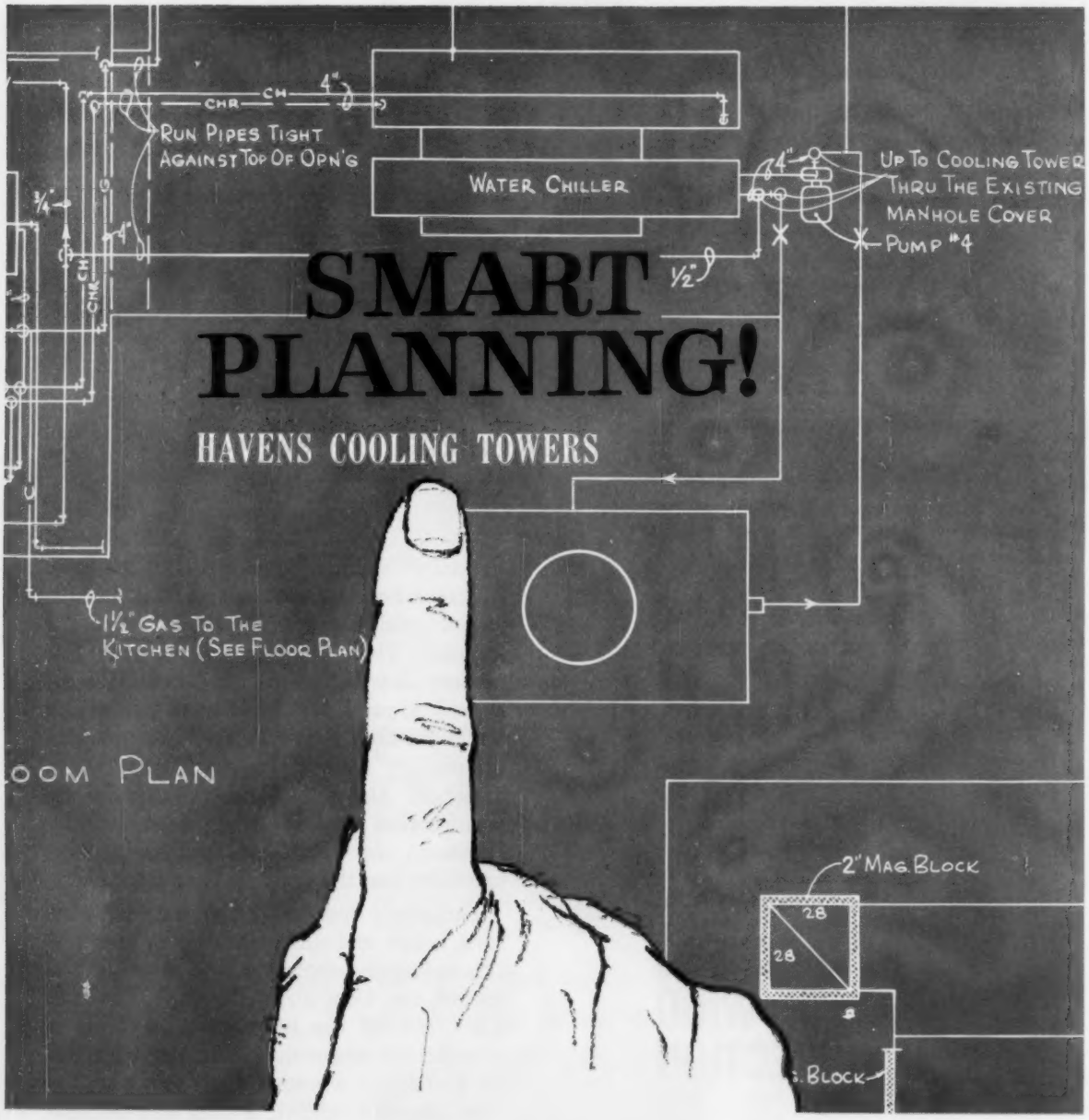
Built for industrial, commercial and home installation – from 3 to 120 tons, single or multiple units. Get full details today.

YUBA

specialists in circular air-cooled condensers and condensing units

YUBA FANDAIRE DIVISION
Tulsa, Oklahoma

YUBA CONSOLIDATED INDUSTRIES, INC.



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If you've got your

EYE

on Economical

Packaged Heat . . .

Look to the New

PETRO PAC

Low or High Pressure

Package Generator

3-Pass Wet Back

Fire-Tube Construction

PLUS Famous Petro Burner...

for gas, oil or gas-oil firing

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Wrings More Heat from Your Fuel Dollar—in Less Space!

Minimum of 80% Combustion Efficiency... Total Fuel Combustion

Especially designed for more economical and efficient heating in small-to-big commercial and industrial buildings ...process load installations.

The new Petro Package Generator is a striking advance in packaged heating . . . combines maximum fuel economy with even greater Petro dependability. It incorporates in the 301 Series a compact 3-pass wet back boiler and the famous Petro forced draft sealed combustion Rotary burner . . . burning low-cost heavier oils . . . in a single completely integrated package. Models Series 300 also available for light oil, utilizing Power-Blast burner.

Top to bottom, inside and out, the Petro Package Generator gives MORE money-saving features than any other generator.

MAXIMUM FUEL ECONOMY Specially designed to fit the outstanding characteristics of the Petro Rotary burner, the 3-pass fire-tube construction affords maximum heat extraction and quick transfer of heat to boiler water . . . insures *over 80% combustion efficiency* . . . faster heating action.

CLEAN, QUIET OPERATION Flame starts clean, burns clean . . . without soot or fume. That's because *total combustion* is achieved through precise control of fuel feed and air supply. The unit operates quietly, too, because it's completely free from flame pulsation, the cause of annoying vibration.

NO STACK The forced draft sealed combustion chamber creates its own draft, so it needs no costly chimney. Only a vent is required.

LOW STANDBY LOSS There's no refractory rear-end to absorb, retain and waste heat. Furnace heating surfaces are exposed to direct radiation for fast heat transfer. In addition, sealed combustion prevents infiltration of cold air during "off" periods.

LOW ELECTRICAL CONSUMPTION Electrical costs are reduced. That's because total electrical horsepower of burner and blower is substantially lower than in the case of many other generators.

ECONOMICAL AND EASY TO INSTALL The unit is completely pre-assembled, pre-wired at the factory . . . ready to set in place and connect. Factory-tested before shipping.

SIMPLE TO MAINTAIN Tubes can be quickly and easily inspected or cleaned by opening hinged front doors, without disturbing the burner. Doors are constructed of heavy gauge steel and lined with insulation to minimize radiation. Access door at rear provides easy inspection of rear turnaround surfaces exposed to heat. The circular rear turnaround can be inspected or cleaned through a conveniently located manhole.

LITTLE SERVICING Combustion problems are reduced because the blower, primary air fan, cup and nozzle are matched exactly to the pressure drop through the boiler for the maximum firing rate. Thus, less adjusting and servicing is required.

ONE-SOURCE PURCHASE Undivided responsibility is guaranteed for the complete package . . . boiler, burner and all accessory equipment.

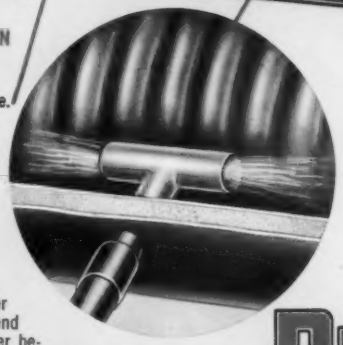
Here's the Inside Story on the Fue

COMPLETELY WATER-COOLED REAR FURNACE Another fuel-saving characteristic of this remarkable heating package . . . with many features that add up to less maintenance and operating costs!
The rear turnaround is completely immersed in water, insuring minimum heat radiation to the rear wall, more surface to absorb heat, lower temperature of flue gases entering second pass of tubes, no refractory to radiate heat on tube sheet, no refractory baffles separating the passes of the boiler to leak and cause higher stack temperatures.

FIRE TUBES A feature of Petro's Three-P is that each pass of tubes has a separate t Because the temperature of the gases is d each tube pass, there are different rates of and contraction of the tubes in each pass. T izes the forces being exerted on each tube eliminates stresses and strains due to unev sion and contraction of varying temperat terminating in a single tube sheet. All tubes and beaded and are 2" in diameter in th sizes and 2½" in the larger sizes.

FEW STAYS Cylindrical turnaround construction requires no circumferential stays—provides easily maintained uncluttered boiler — with no flat spots to collect scale. Only a few stays in the wet rear wall.

OBSERVATION PORT Allows quick and easy inspection of fire.



WATER BLENDING DEVICE Distributes the return water toward the front and rear of the boiler causing it to blend with boiler water before contacting any heated surfaces. This minimizes thermal shock.

3-PASS WET Triples heating m make three pass tubes, reversing flue gases to exit design permits ju furnace for good penalty in operati pressure drops.

PETRO

T.M. Reg. U.S. Pat. Off.

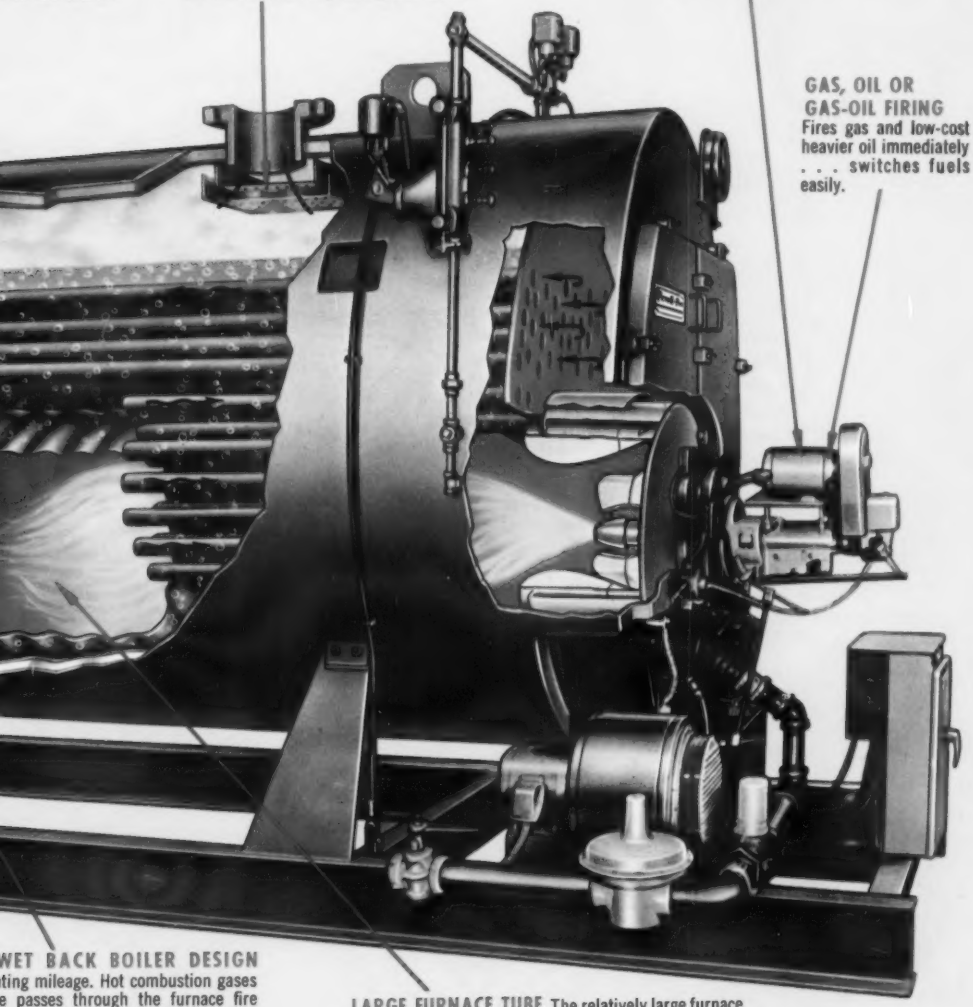
Fuel-Saving 301 Series Petro Package Generator

ree-Pass design
rate tube sheet.
es is different in
tes of expansion
ass. This equal-
tube sheet and
uneven expan-
mperature tubes
tubes are rolled
in the smaller

"INSTANCOIL" WATER HEATING COILS Instantaneous, indirect (tankless) hot water coils are available for quick, hot water supply. (Optional)

INTEGRAL STEAM SEPARATOR Mounted in the boiler below the steam nozzle, it insures dry steam at the boiler outlet even under less favorable operating conditions.

FORCED DRAFT SEALED COMBUSTION ROTARY BURNER Permits highly efficient pressure firing. Only accurately metered air can enter the furnace through the burner. Precise control of fuel feed and air supply insures highest combustion . . . clean, smokeless operation. Gas phase of burner incorporates multiple jets. Gas is discharged into air stream behind vaned burner head, providing uniform mixture of air and gas before entering the combustion chamber.



GAS, OIL OR GAS-OIL FIRING Fires gas and low-cost heavier oil immediately . . . switches fuels easily.

WET BACK BOILER DESIGN
ting mileage. Hot combustion gases
e passes through the furnace fire
rsing direction twice, which causes
to exit at rear of boiler. Three-Pass
mits just enough pressurization in
r good operation but imposes no
operation costs because of excessive
rops.

LARGE FURNACE TUBE The relatively large furnace diameter of the Petro Pac Three-Pass boiler exposes more primary heating surface to the radiant effect of the flame . . . insures that combustion takes place before the flame enters the rear turnaround. This — plus wet back — insures that the second pass tube sheet will be subjected to flue gases at a low temperature.

Standard Equipment

The generator is 3 pass wet back construction, complete with steel skids, steel jacketed insulation, cleaning tools and observation port.

Hinged front doors are constructed of heavy gauge steel and lined with insulation to minimize front end radiation.

STEAM TRIM — Steam gauge, syphon and cock; safety valve(s) per ASME Code; combination water column, pump control and low water cut-off; gauge glass with guards; try cocks valves and fittings. (Injector assembly and feed valves are standard on high pressure steam generators with 500 sq. ft. of H.S. or more.)

WATER TRIM — Pressure gauge, thermometer, ASME relief valve, low water cut-off piped and wired to package.

GAS, OIL AND GAS-OIL BURNERS — *Series 300*, MH RA-890E* Electronic Combustion Safeguard with UL Approved Cam Timer Control . . . assembled and wired in a totally enclosed panel; operating and limit pressure controls, gas-electric ignition assembly for gas firing and direct spark ignition for light oil firing. On-off, on-off W.L.F.S. or modulation is available. Refer to individual price sheets for standard and optional fire control.

Series 301, FP-2 for all fuels with gas-electric ignition. Modulation is standard on all sizes.

*Fireye FJ-2 optional at extra cost for oil, gas, or combination gas-oil generator.

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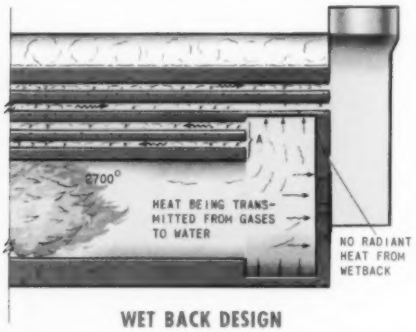
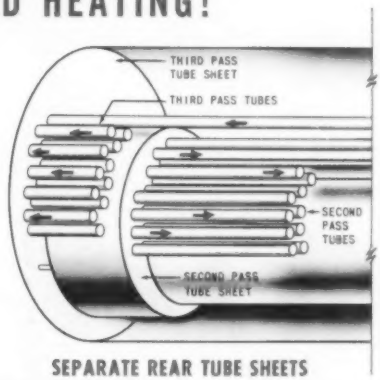
WHY THE PETRO PAC IS A STRIKING ADVANCE IN PACKAGED HEATING!



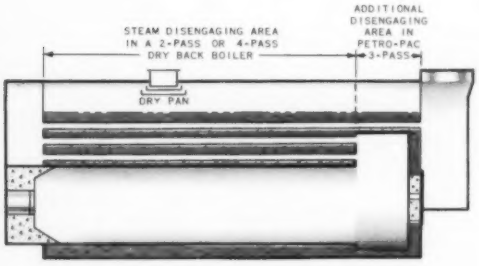
WET BACK DESIGN

The cylindrical rear turnaround is completely immersed in water. This insures that all surfaces transfer heat to boiler water and that no heat is radiated to the rear tube sheet. There's no refractory to maintain. No refractory baffles to leak.



SEPARATE REAR TUBE SHEETS

Because of different gas temperatures, tubes in the second and third pass expand and contract at different rates. But since these tubes terminate in separate tube sheets, stress and strain on ligaments are more nearly equalized in each tube sheet.



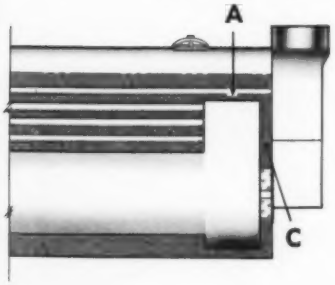
ADDITIONAL STEAM DISENGAGING AREA

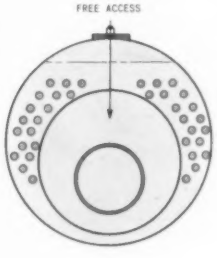
Water extends over rear turnaround to rear of boiler, giving more disengaging area than do some dry back boilers. The dry pan on all steam generators is located under the nozzle outlet.

FREE FLOW WATER CIRCULATION

There are no tubes above the furnace in the third pass. The opening between the tubes in the second pass permits free flow of water around and above the furnace tube — the hottest part of the boiler. Neither are there any tubes below the furnace, permitting free circulation of water around the furnace tubes. This provides adequate space between furnace and tubes . . . insures free flow of water.

EASY ACCESSIBILITY TO WATERSIDE SURFACES FOR CLEANING AND MAINTENANCE





There are no tubes over the rear turnaround at designation "A". This makes the furnace and rear turnaround easily accessible for cleaning through a convenient manhole. The flat surface at designation "C" on the rear of the turnaround can also be cleaned through the manhole. Easy maintenance of waterside surfaces means longer boiler life.

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you'll want to know...

Heat Pumps Condition Air in Third Largest Enclosed Mall Center

THE world's largest installation of packaged heat pumps has been installed in an enclosed mall center in Birmingham, Ala. Eastwood Mall Shopping Center employs 47 water source heat pumps with a cooling capacity of 1015 tons to provide year 'round air conditioning. The $4 million center houses 43 stores under a single roof covering 7½ acres. In addition, the center includes a separate bowling alley supplied with 90 tons of cooling, also provided by heat pumps.

The largest of the heat pumps in the Eastwood center have capacities of 50 tons. The average size unit used is 15 tons, and some of the smaller stores are equipped with 3 ton units. Five 15 ton units supply heating and cooling to the main mall area, according to the Typhoon Heat Pump Div., Hupp Corp.

The heating and cooling load was calculated for each store separately and then totalled with the cooling and heating required for the mall areas. Calculations indicated that the total loads were nearly balanced. The cooling load is 803 tons for the stores plus the mall load of 70 tons. The winter heating load is 12,733,000 Btu per hr, not considering heat gains from people or lights. Consideration of this heat gain brings the seasonal loads into approximate balance.

All air flows from the stores into the mall from which it is eventual-

FLOODED ROOF of Eastwood Mall, Birmingham, Ala., reduces solar heat gain. Water is supplied by the discharge of condensers used to cool the 7½ acre complex

ly exhausted. This reduces the cooling load. A breakdown of the mall cooling load is as follows: 22 percent for conduction; 32 percent for solar gain; 11 percent for lights; 21 percent for infiltrating air; and 14 percent for occupancy. In the winter, very little heating is required on the mall during occupied periods.

Outside design conditions are 10 F for winter and 95 F dry bulb, 78 F wet bulb in summer. Inside design conditions are set at 70 F for winter and 80 F dry bulb, 67 F wet bulb in summer. Relative humidity for summer conditions are 72 percent outside and 50 percent inside. The loads are divided, on the average, at 79 percent sensible and 21 percent latent.

In the restaurant and cocktail lounge, because of the higher latent heat load due to heavier occupancy and cooking, supplemental electric blast heaters are used in the air distribution system for humidity control through reheat.

A large underground stream at a depth of 80 to 120 ft assures a continuing supply of water for the heat pump system. Three wells were sunk. One handles the majority of the system's needs, and the second comes on when peak conditions require. The third functions as a standby. Ground water is at a temperature of 65 F year 'round.

During cooling the heat pumps use about 1 gal per ton per min, and for heating require 1.25 gal per ton per min. An 8 in. pipe line brings the water to the center and branch lines; smaller lines distribute the water to the individual heat pumps.

In the summer, discharge water from the heat pumps is 90 F. In the winter it's 46 F. Condenser water is exhausted to the roof in the summer where it is used to reduce the solar heat gain by flooding the roof to a depth of 2 in. From the roof it flows to the storm drains.

PALMS, FERNS, AND BANANA TREES brought in from Florida are expected to thrive in the Mall's air conditioned atmosphere. Viewed here is the 750 ft long main hall area

Each heat pump system is under thermostatic control, regulated by the individual store manager. The larger units are multiple compressor models which give step control in meeting less than maximum cooling and heating loads. When loads are light only one or two compressors will operate; additional compressors come on when needed.

Lewis Freedland was the engineer for the project, and Willard Thorsen was the architect.

Argonne Experiments Enable Engineers To Forecast Air Pollution

AN ARGONNE National Laboratory scientist told delegates at a meeting on air pollution control in New York City that knowledge gained through years of experimentation at Argonne has enabled pollution engineers to forecast more accurately the degree of air pollution the public will experience.

Harry Moses, associate meteorologist, Radiological Physics Division, explained at the 54th Annual Meeting of the Air Pollution Control Association held in June how the Laboratory's unique, experimental 111-ft high smoke stack is utilized in the study of smoke rise and behavior.

Smoke plumes are obtained by injecting fog-oil droplets into the air stream and blowing them out at controlled rates up to speeds of 30 mph. The plumes are photographed for some distance after they leave the stack. The height to which the smoke will rise in the atmosphere is of importance in calculating the resulting concentrations of contamination at ground level—the higher the smoke rises, the less pollution there will be near the ground.

According to Mr. Moses, smoke

ASHRAE Lab To Remain Closed Without Membership Referendum

THE Cleveland Research Laboratory of the American Society of Heating, Refrigerating & Air-Conditioning Engineers will remain closed, and no membership referendum will be held to determine support or opposition to this decision. This was decided at the opening session of the Society's 68th annual meeting held in Denver, Colo., in June.

E. P. Palmatier, chairman of the Research & Technical committee, offered a motion to support the Board of Directors in their decision to close the laboratory and to conduct all future research activities in private research institutions and in universities and colleges. Following this, R. H. Tull, president of the Society at the meeting, asked that R. M. Vreeland, legal counsel for the Society, express the legality of the matter. He reported that the Board of Directors has the right and authority to carry on the activities of the Society under the corporation laws in New York.

John Everetts, Jr., the newly elected president of the Society, reported that all chapters had been notified at the February 1961 meeting of the action of the Board of Directors to close the Research Laboratory in Cleveland. Only 31 Chapters replied on this question as to whether the Board of Directors should be upheld in their decision or if a referendum among all the members should be held. Of the 31 Chapters heard from on this, 23 upheld the Board decision and eight opposed the decision.

E. P. Palmatier spoke again in favor of his motion and reported that the Research and Technical committee had reversed its previous decision on this matter and that it now feels the Board should be supported in its decision to close the laboratory.

Speaking against the Board action to close the laboratory without a referendum were Herbert T. Gilkey, John H. Clarke, and Edward R. Teske. Speaking for the Board action were William Holliday, Neal Hutcheon, and Elmer Queer.

When the vote was called for, it was pointed out that all the proxies for the election of officers previously signed by members not planning to be present would be voted in favor of Mr. Palmatier's motion. As a result, the motion was passed with a large majority.

In his remarks as the outgoing president of the Society, R. H. Tull reported that the merger of the two predecessor Societies has now been completed, and that John Everetts, Jr. is the first president of ASHRAE to serve the full one year term. Mr. Tull said that the financial problems of last year have been solved, and that this year it has not been necessary to draw upon the Reserve Fund for operation of the Society. This is partially due to the lower cost of research activities made possible by the closing of the Research Laboratory, he added.

Mr. Tull reported that the final arrangements were being made for the ASHRAE-Kansas State University environmental laboratory investigation to be conducted at Manhattan, Kan., by the University faculty.

Also, he reported that the ASHRAE Guide & Data Book for 1961 would not be ready until late summer this year.

In the later part of this month the ASHRAE headquarters will be moving into the new United Engineering Center in New York City, according to Mr. Tull.

Newly elected officers for the next year are as follows:

President: John Everetts, Jr., Philadelphia, Pa.; first vice president: John H. Fox, Toronto, Ontario; second vice president: Frank H. Faust, Tyler, Tex.; and treasurer: John E. Dube, St. Louis, Mo.

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rise depends on several factors: the velocity of smoke in the stack; the temperature and density of the smoke; and the wind speed and stability of the atmosphere. All these factors have been measured at Argonne and compared to long-known formulas. The current experimentation has confirmed the reliability of some of the formulas and the unreliability of others. Up to the present time there have been few reliable measurements under varying stack and meteorological conditions, adequate to test these formulations.

The additional knowledge gained at Argonne has given air pollution engineers a better idea of what height of rise formulas are reliable in the design and modification of smoke stacks.

Argonne has been conducting the study of air behavior in cooperation with New York University. Gordon H. Strom, Professor of Aeronautics at New York University, collaborated with Mr. Moses at the Laboratory during the summers from 1955 to 1958 and again in 1960.

The current New York meeting has attracted air pollution engineers, state and municipal air control officers, designers and manufacturers of air pollution equipment, U. S. Public Health officials, and meteorologists.

Argonne National Laboratory is operated by the University of Chicago for the U.S. Atomic Energy Commission.

you'll want to know

Physicians Give Opinions on Smog

A RECENT report that an estimated 2500 persons may have taken their doctor's advice to leave Los Angeles and smog within the past several years is seen as an endorsement of the Los Angeles County Air Pollution Control District Board of Supervisors' policy of dealing with smog as a critical health hazard, according to Air Pollution Control Officer, Smith Griswold.

Results of a survey of physicians, made jointly by the Los Angeles County Medical Association and the Tuberculosis and Health Association of Los Angeles County indicate that 77 percent of the County's physicians believe that air pollution adversely affects the health of their patients. The results also indicate that an estimated 10,000 patients have been advised to move out of the Basin.

"The air pollution control program in this county has operated on the premise that smog is a menace to health, even though we have never had the medical evidence to prove it," Mr. Griswold said. "Now that the medical picture is taking shape, we already have carried out the most stringent program possible, and are going full speed to roll smog back to the pre-war level by 1965," he concluded.

ARI To Certify Heat Pumps

AN ARI certification program for unitary heat pumps will be initiated as soon as test equipment can be installed and contracts and other preliminary details are completed, it was announced by John A. Gilbreath, chairman of the Unitary Air-Conditioner Section of the Air-Conditioning and Refrigeration Institute.

The program will include unitary heat pumps up to 135,000 Btu per hr cooling capacity, but will not include reverse-cycle room air conditioners. It will closely follow, in contractual relationships, procedures, and testing of equipment, the Unitary Air-Conditioner Certification Program, which has been in operation for more than two years. However, because of the more complicated nature of the equipment, a number of modifications have had to be made in testing requirements.

Like the Unitary Air-Conditioner Program, the Heat-Pump Program will be administered by ARI under the direction of the Unitary Air-Conditioner Section.

As a pre-requisite to approval of the program by the Section, a revised ARI Standard for Unitary Heat Pump Equipment (ARI Standard 240-61) has just been published. The last previous revision, published in 1957, has been completely rewritten to provide a basis for the proposed certification program.

A particular feature of the new standard are the revised rating conditions which call for standard rating capacities for both summer (at 95 F outdoors) and winter (at 45 F outdoors) operation, and an additional required winter condition rating at 20 F outside temperature, to cover operation at lower outside temperatures than was called for in the previous revised ARI standard of 1957.

Another requirement before activation of the program for heat pumps is the installation of additional test equipment at Electrical Testing Laboratories in New York, where heat pumps units are to be tested under contract with ARI, just as unitary conditioners are now tested.

Copies of the new Heat Pump Standard are available from ARI at a price of 50 cents each. The address is 1346 Connecticut Ave. N.W., Washington 6, D.C.

First Quarter Unitary Shipments Up 23 Percent

MANUFACTURERS' shipments of unitary air conditioners, including heat pumps, in the first quarter of 1961 totaled 77,551 units, a gain of 23 percent over the 62,856 units shipped in the first quarter of 1960, the Air-Conditioning and Refrigeration Institute reports. Total shipments for 1960 were only about 9 percent above total 1959 figures, and first quarter 1960 shipments were about 10 percent above the same period of 1959.

The figures released by ARI cover all unitary equipment, but do not include window or wall units.

Heat pump shipments in the first quarter of 1961 totaled 12,160 units, a gain of almost 60 percent over the same period in the previous year. Self-contained heat pumps accounted for 8200 units of the 1961 total.

These figures represent 90 percent of total industry shipments, according to the ARI.

Studies Show . . .

Air Conditioning Pays for Itself

STUDIES in 14 industries show that increases in earnings due to air conditioning for worker comfort have regained from 20 to 100 percent of the investment in air conditioning installations during the first year.

Russell Gray, president of Carrier Air Conditioning Company which conducted the survey, said the 19 factories studied make products ranging from auto seat covers and filing systems to electronic components for the Nike Zeus missile.

American Kleer-Vu Plastics, Inc., which makes transparent page protectors in a plant at Brownsville, Tenn., earned a 32 percent return last year on its investment in air conditioning, Mr. Gray said. "Summer output jumped so substantially that annual production was up 6.5 percent," he added. "Absenteeism dropped 17 percent and labor turnover went down 23 percent from previous levels."

Mr. Gray said the Transicoil Div. of Daystrom, Inc. in Worcester, Pa., which makes mechanisms to keep missiles on target, earned a 41 percent return on its investment after an existing system was re-engineered. Increased summer production raised the annual output 2.7 percent and the number of rejects was reduced 5 percent. Labor turnover dropped 25 percent and absenteeism was virtually eliminated.

Mr. Gray said the Densal Manufacturing Corp., of West Springfield, Mass. increased its earnings enough to pay off the cost of the air conditioning system in less than one year. Others firms reporting good returns on their investment in air conditioning, according to Mr. Gray were Simpson Electric Co. of Chicago with an 80 percent return, Acme Visible Records, Inc. of Crozet, Va. with 35 percent, and Nardis Sportswear of Dallas with 31 percent.

Reductions in absenteeism, labor turnover, training expenses, spoilage, and increases in worker productivity at the firms surveyed were not large when considered separately, Mr. Gray said. "But when all were combined and translated into terms of dollars and cents, the plant officials were amazed at the amounts involved."

The survey showed that the average annual owning and operating cost of air conditioning was less than 2 percent of annual wages and the resulting increased returns almost always exceeded the cost of owning and operating the system.

From the 19 plants studied, Carrier was able to calculate today's average costs for a "high quality" factory air conditioning system.

The plants, Mr. Gray said, averaged 30,000 sq ft in floor area occupied by 150 workers on the first shift and 50 on the second. The initial investment per worker averaged $400, or $79,000 for the space described. The average annual owning and operating cost for air conditioning was $76 per worker. The cooling capacity required was 140 tons.

Mr. Gray said there are approximately 6,000,000,000 sq ft of factory floor area in the nation, of which only 6 percent is air conditioned. A sizeable portion of this area may not be profitable to air condition, he said, but the rest represents a potential area for increasing production and income.

Gas Heating Provides Flexibility For Private School Serving 14 Grades

THE UNUSUAL REQUIREMENTS of the Francis W. Parker School in Chicago—a facility which will house 14 different grades from pre-kindergarten through high school—called for a heating and ventilating system of extreme flexibility. The problem was to provide heating and ventilating for a complex of assorted conventionally-sized classrooms, offices, laboratories, etc., as well as for unusually large areas of general assembly.

These areas include a 700-seat auditorium, a cafeteria, an all-purpose room containing a small stage, and classrooms. Classrooms have been designed to accommodate a maximum of only 25 students (lower grades limited to 20), and in almost all cases are further broken down to provide separate work areas and a private office for the teacher, according to the American Gas Association.

The school will be a three-story structure, built in a U shape. Heating will be supplied by two gas-fired steam boilers, each rated at 228 hp, to maintain a 70 F design temperature. The boilers will supply steam to heat exchangers where it will heat water for a perimeter heating system. The system is broken down into three major zones: one for the main building and one each for the east and west wings.

To solve the problem of supplying heat to the small classroom

areas, heating coil ventilating units will be used, each controlled by individual thermostats. Capacities of these units have been based on 50 percent outside air at −10 F outside air temperature. For the extremely large areas such as the gymnasium and lockers rooms, fan systems using steam in coils will be used.

Architects for the project were Holabird and Root of Chicago. The total cost of the heating system is calculated to be $225,000, or approximately $2.08 per sq ft.

you'll want to know

Los Angeles Claims To Be Cleanest Area

DESPITE the notoriety of smog, Los Angeles air is the cleanest of the four largest U.S. industrial communities, according to a recent report published by the Los Angeles County Air Pollution Control District. Comparison of dustfall measured in Los Angeles, New York, Chicago, and Philadelphia shows that the amount of solid material settling out of the air in Los Angeles is about one-half that of Chicago.

According to the survey by W. G. Christy, New York consulting engineer, the average dustfall during 1959, expressed in tons per sq mile per month, was: Los Angeles, 28.9; Chicago, 48.7; Philadelphia, 60.3 and New York, 70.6.

The maximum monthly dustfall measured in Los Angeles was 81.0, while Pittsburgh reported a maximum of 403. Milwaukee County, Wis., showed the highest monthly average, 466 tons per sq mile, but Pittsburgh, which is the next highest, did not report soluble solids, while other areas reported both soluble and insoluble solids.

Insulated Ductwork and Piping Provide Extra Fire Protection in Hospital

THE Pediatric Hospital for the Mentally Deficient in Chicago is virtually fireproof—especially in so far as the heating, ventilating, and air conditioning installation is concerned. All inaccessible sections of ductwork and dual temperature piping are covered with a combination of insulation and facing that incorporates vapor impermeance and fire resistance.

Radiant aluminum ceiling panels and diffusers for air distribution supply year 'round comfort. This type of system was selected for the following reasons:

1) It permits a reduction in air volumes due to the cooling effect of the ceiling.

2) Provides relatively warm floors, both summer and winter.

3) Places radiant coils in an accessible location for repair.

4) Provides for future individual room control at practically no additional cost. (A nipple and union were supplied to each coil supply connection for a future modulating valve.)

A 440 ton capacity compressor system cools all floors of the eight story building, according to the American Sisalkraft Co. The equipment is divided—equipment in the penthouse cools the top six floors, and that in the basement cools the below grade areas and the first and second floors including a cafeteria.

Freidman, Alschuler & Sincere were the architects for the project, and E. R. Gritschke & Associates was the consulting engineering firm who designed the heating and air conditioning systems.

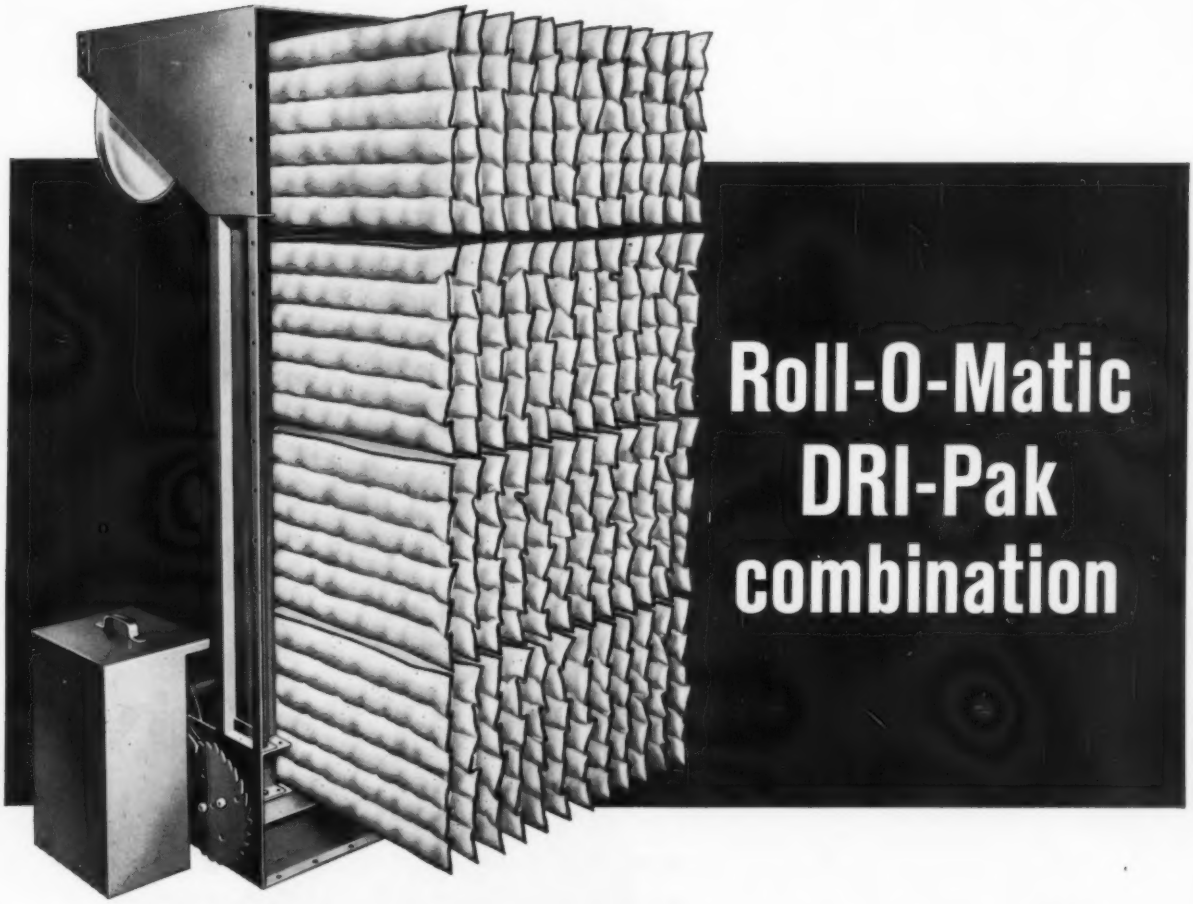
Propose Standard for TFE Plastic Sheet

THE FIRST of a series of standards for TFE-fluorocarbon resins is now being considered by the industry for adoption, according to the Commodity Standards Div., Office of Technical Services, Business and Defense Administration, U.S. Department of Commerce.

The standard establishes requirements and methods of test for the material, dimensions, workmanship, and physical and electrical properties of three grades of TFE sheet furnished in minimum thicknesses of 1/32 in. Requested by the Fluorocarbons Div. of the Society of the Plastics Industry, the standard embodies suggestions from other interested industry organizations also. After sufficient endorsements are received from representative manufacturers, distributors, and users, it will be published as a voluntary standard of the trade.

Copies of the standard, entitled "Recommended Standard for TFE-Fluorocarbon Resin (Polytetrafluoroethylene) Sheet, TS-5528," are available on request from the Commodity Standards Div., Washington 25, D.C.

A new AAF development in air filtration



LOW MAINTENANCE of the Roll-O-Matic

HIGH EFFICIENCY of AAF's new DRI-Pak

Now it's possible to get air-cleaning efficiencies as high as 97%* with only a fraction of the maintenance usually required. By combining the new DRI-Pak unit filter with the fully automatic Roll-O-Matic as a pre-filter (in one integral unit), AAF has more than doubled the life of the highly efficient DRI-Pak. And simple, once-a-year replacement of the Roll-O-Matic's media roll takes care of all pre-filter maintenance needs.

For complete information on this new high-efficiency, low-maintenance air filtration system, call your nearby AAF representative; or write for Bulletin No. 228. Address: Robert D. Moore, American Air Filter Co., Inc. 373 Central Avenue, Louisville, Kentucky. In Canada: American Air Filter of Canada, Ltd., 400 Stinson Blvd., Montreal 9, Quebec.

**Based on the National Bureau of Standards Dust Spot Method on Atmospheric Dust.*

AAF **American Air Filter**

BETTER AIR IS OUR BUSINESS

it's always

With 'Buffalo' Air Conditioning Cabinets it's always "Fair Weather". Accurate control...performance as rated...ease of installation...quietness...true low cost based on long-term service... ease of maintenance...flexibility of operation...you want them all if you want perfection. You can get some of these features elsewhere. You can get them all from 'Buffalo'.

New literature is now available describing the complete line of 'Buffalo' Air Conditioning Cabinets.

BUFFALO FORGE COMPANY
Buffalo, New York

fair
weather
CHANGE
Rain
Storm
Fair
Dry
29
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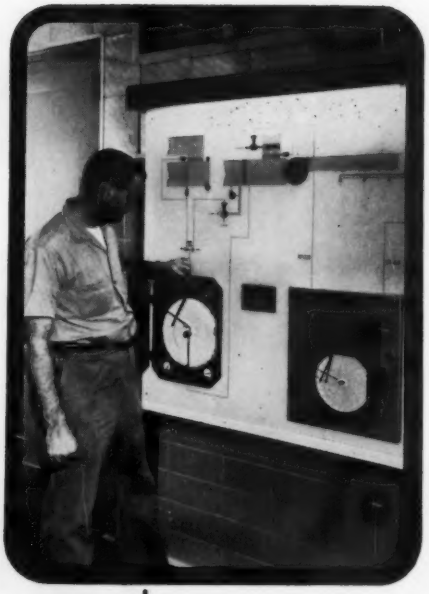
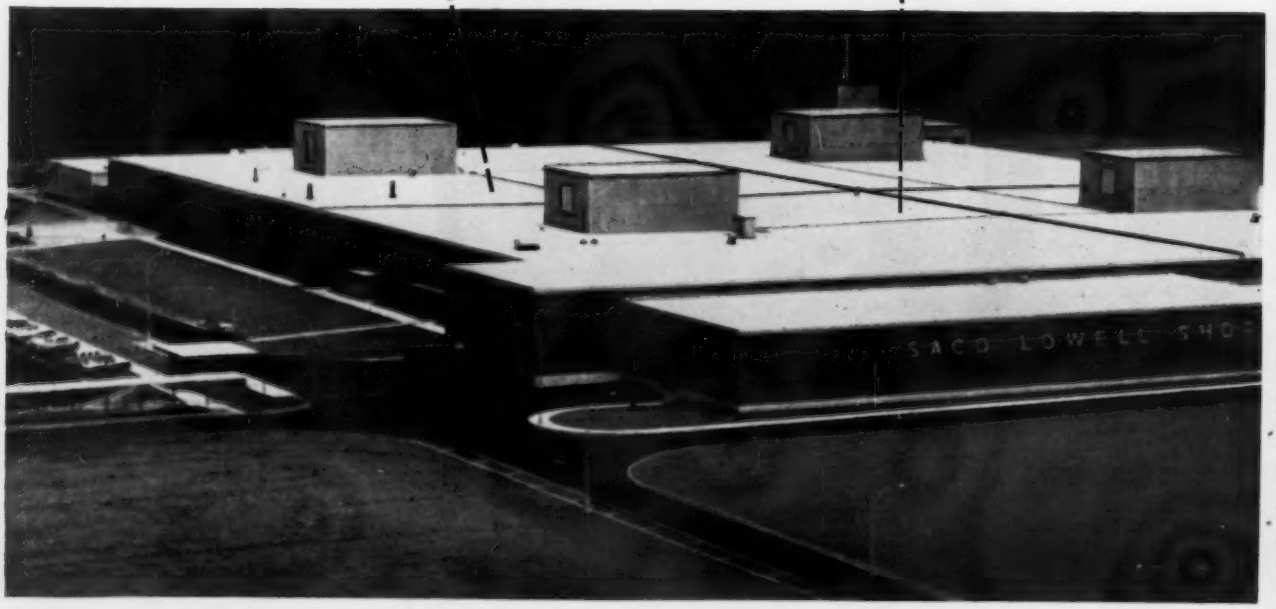
Sales Demonstration. Saco-Lowell machinery is demonstrated in a special sales room. The air conditioning system serving this area can be observed and controlled from this Johnson graphic panel in the sales room.

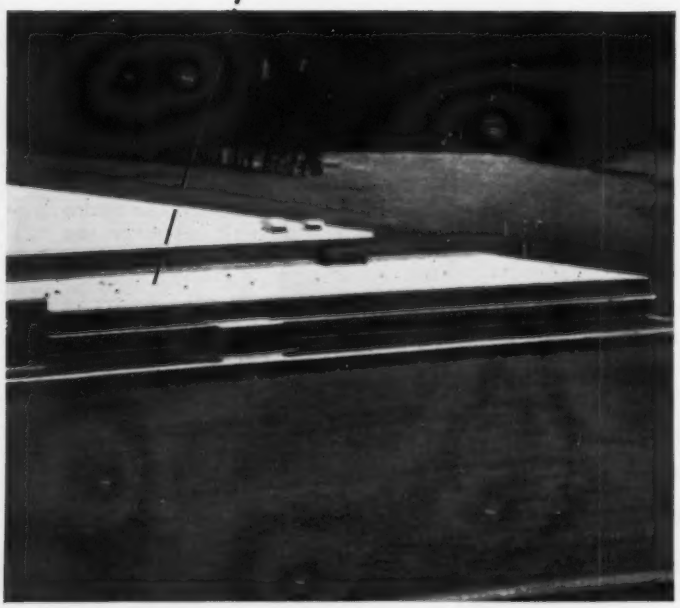


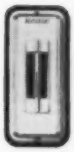
Manufacturing. Johnson Control regulates both temperature and humidity, assures an ideal working climate for employees. Humidity regulation also prolongs equipment life, protects precision machine parts output from damaging condensation and rust.

Laboratory. Fibers produced on Saco-Lowell textile machinery are tested under constant temperature and humidity conditions in accordance with ASTM standards. At right is a Johnson Recorder-Controller mounted in an aspirating cabinet.



CONTROLLED ENVIRONMENT keynotes plant efficiency





Johnson system regulates temperatures and humidities

As the photographs illustrate, controlled thermal conditions are an important asset for production and sales by the Textile Machinery Division of Saco-Lowell Shops, Easley, S. C. The modern air conditioned structure contains over 450,000 square feet of floor space.

A specially planned Johnson Pneumatic Control System maintains the exact temperatures and humidities required for manufacturing, testing, and product demonstrations, as well as for the year 'round comfort of the 1700 plant and office employees.

Here, as in thousands of other Johnson-equipped plants throughout the nation, a controlled thermal environment results in greater productivity, uniformly better product quality, lower costs, and improved worker efficiency.

Johnson Pneumatic Control Systems are applied to all types and makes of air conditioning, heating, and ventilating systems, and to a wide range of industrial processes. Next time you have a problem of temperature, humidity, or pressure control, take advantage of the unmatched performance and lifetime economy features of a Johnson System. Johnson Service Company, Milwaukee 1, Wis. 110 Direct Branch Offices.

JOHNSON CONTROL

PNEUMATIC SYSTEMS

DESIGN • MANUFACTURE • INSTALLATION • SINCE 1885

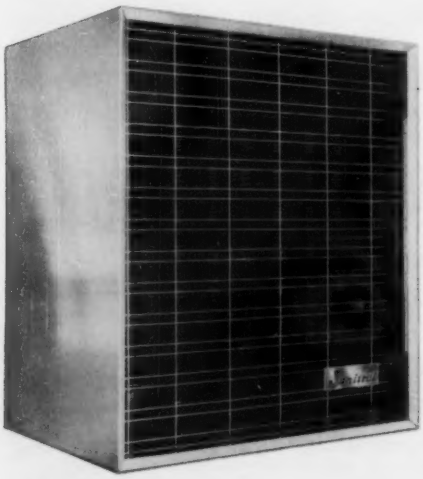
1170

◀ Saco-Lowell Shops, Textile Machinery Division, Easley, S. C.; Lockwood Greene Engineers, Inc., engineers and architects, Spartanburg, S. C.; Daniel Construction Company, Inc., general contractor, Greenville, S. C.; Buensod-Stacey, Inc., mechanical contractor (original project), Charlotte, N. C.; Davis Mechanical Contractors, mechanical contractor (additions), Greenville, S. C.

WHY TEMCO AIRCRAFT CORPORATION RE-SPECIFIES JANITROL

"MAINTENANCE IS NO PROBLEM"

Important Breakthrough in Unit Heater Styling and Engineering. . .



New JANITROL "67" Series

New outside! Beautifully proportioned, with crisp, clean-lined styling to harmonize with any commercial-industrial installation requirement.
New inside! Loaded with important technological advancements to assure performance and reliability far ahead of any other unit heater on the market today.

SOME GOOD REASONS TO SPECIFY JANITROL "67" UNIT HEATERS

- New improved fan design assures exceptionally low sound level.
- Delayed fan control — allows full utilization of fuel; eliminates cold blasts when unit comes on.
- Fully enclosed sides and bottom; finished in neutral Phoenix Beige baked enamel, with metallic gold grille.
- Prelubricated motor — continuous duty, rubber-cushioned.
- Adjustable Direct-A-Flow Louvers are concealed.
- Complete gas shut-off in case of pilot failure.
- Low Voltage thermostat
- Eleven sizes from 30,000 to 250,000 Btu/hr. inputs.
- Famous Multi-Thermex Heat Exchanger—over 3 million steel heat exchanger tubes in use since 1940, with less than ¼ of 1% replacements for any cause!

UNIT HEATERS AGAIN AND AGAIN...

WITH JANITROL UNIT HEATERS"

Addition of 30 More JANITROL UNITS Brings Total to 179 at Temco's Garland, Texas Plant

The complete satisfaction you can expect by specifying Janitrol unit heaters for your commercial-industrial jobs is clearly reflected by Temco's outstanding (but not at all unusual) experience with Janitrol performance.

Janitrol first went to work for Temco Aircraft Corporation in 1946, when 100 Janitrol units were installed. Temco added 43 more Janitrol's in 1951-52 and six in '53, to keep pace with their growing Garland plant. Since 1953, 30 more Janitrol's have gone on the job as the plant has grown.

Says Temco: "Janitrol unit heaters have proven very satisfactory for us, and maintenance is no problem."

Among the features that make Janitrol your best specification is the exclusive Multi-Thermex Heat Exchanger. It is virtually indestructible. In fact, replacements for any cause have been less than ¼ of 1% in over three million heat exchanger tubes produced since 1940.

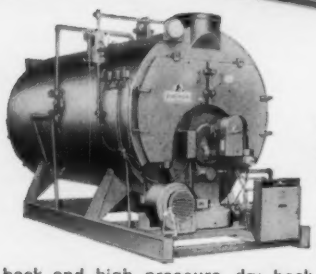
Today's new Janitrol gas unit heaters are even better than ever, with great new functional styling, and installation flexibility that enable you to "customize" commercial-industrial jobs to individual requirements at lowest cost. Get all the facts on the new Janitrol 67 Series unit heaters from your Janitrol representative.

In addition to space heating, Temco, like many other firms, has adapted Janitrol Unit heaters for use in manufacturing or processing. Here, a high velocity heater, located above the lighting fixtures, provides heat through a large fabric duct for use in curing aircraft fuel tanks that are being overhauled.

JANITROL®
Heating and air conditioning
COLUMBUS 16, OHIO (IN CANADA: MOFFATS LTD., TORONTO 15)

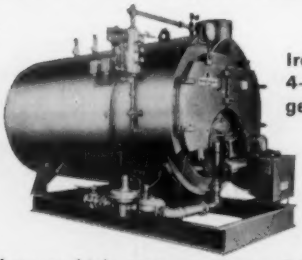
A DIVISION OF M-R MIDLAND-ROSS CORP.

ALSO MAKERS OF ***Surface*** INDUSTRIAL FURNACES AND ***Kathabar*** HUMIDITY CONTROL



IronFirepak 2-pass generator

Low pressure steam or hot water, full wet back and high pressure dry back designs. Size range, low pressure 50 to 600 BHP; high pressure 30 to 600 BHP. Light oil or gas in all models. Residual oil from 50 BHP. Gas-oil all sizes.



IronFirepak 4-pass generator

Low or high pressure steam, full wet back, no refractory baffles. Light oil, gas or gas-oil. Size range 30 to 100 BHP high pressure; 50 to 100 BHP low pressure.

WIDE RANGE to fit varying conditions of all heating and power applications

CAPACITIES: 10 to 600 BHP, low pressure steam or hot water and 30 to 600 BHP high pressure steam and hot water.

FUELS: Residual oil, No. 2 or light oil, gas and gas-oil.

TYPES: 3-pass steel firebox generators, 2-pass and 4-pass Scotch marine package generators.

HEATING AND AIR CONDITIONING
AIRCRAFT COMPONENTS AND EQUIPMENT
MISSILE AND AIRCRAFT GYROSCOPES
ELECTRONIC EQUIPMENT
CONTROL INSTRUMENTS

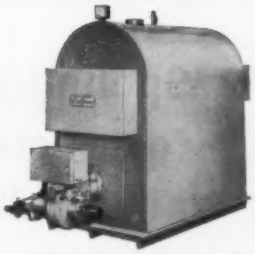
THE IRON FIREMAN

Iron

IronFirepak is the name of a complete family of generators designed around a service-proved firing system with exceptional performance

The IronFirepak generator line varies greatly in size and design in order to provide models that meet the many different power and heating requirements with efficiency and precision. The different design types, however, have many outstanding qualities that are common to all. They all deliver better than 80% thermal efficiency. In all models the boilers are designed to fit burner firing characteristics. All are exceptionally economical, in fuel, in maintenance, in space requirements, in installation. All are of rugged construction, built to the highest standards in the industry.

Most models are complete units, with operating and limit controls factory installed and tested, delivered at the site ready for service connections. No high stack required—merely an exhaust vent.



IronFirepak forced draft steel firebox generator

Extremely compact, highly efficient design is made possible by the Iron Fireman WhirlPower burner, which requires no combustion supporting refractory; no secondary air system. Sizes, 10 to 60 BHP. Gas, light oil or dual-fuel.

IronFirepak steel firebox generator with atmospheric gas burner

Operates on normal gas line pressure; minimum electrical requirements. Delivers rated output equal to same boiler with power gas or oil firing. Sizes, 10 to 60 BHP.

Send coupon for full information and specifications

Fireman®

Iron Fireman Mfg. Co., 3140 W. 106th St., Cleveland 11, Ohio
(In Canada, 80 Ward St., Toronto)

Please send full information and specifications on IronFirepak Package Generators as follows:

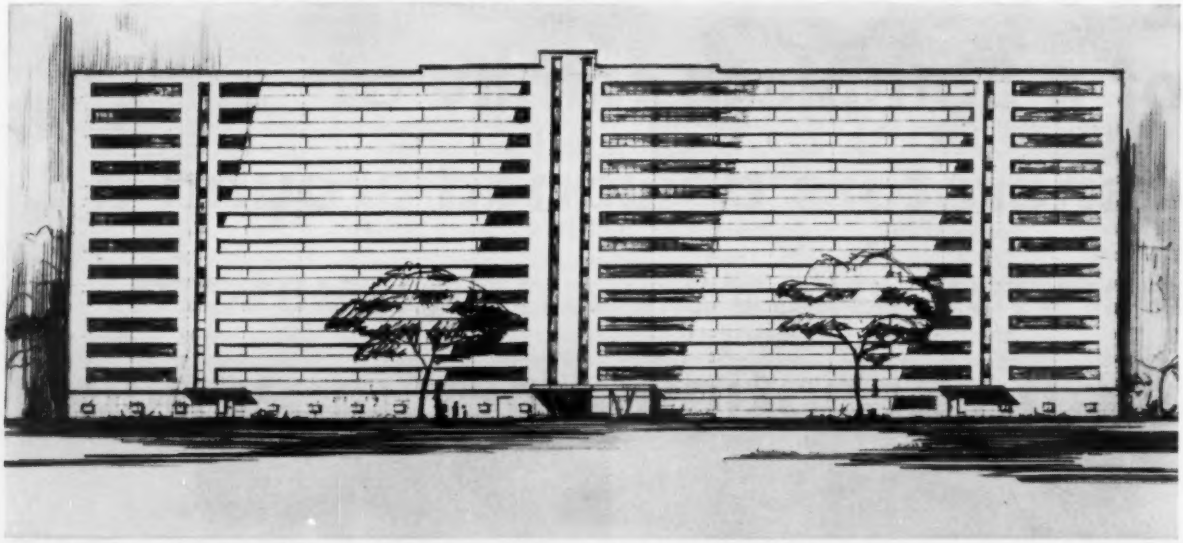
☐ 2-pass ☐ 4-pass ☐ Steel firebox, gas, oil, dual-fuel ☐ Steel firebox, atmos. gas

Name_____

Address_____

City_____ State or Prov._____

Largest apartment
ever to be built
in Cleveland...



New Terrace Park Apartments becomes Cleveland's largest apartment. Marvin Helf, Inc., developer and general contractor. Spohn Heating and Ventilating Company, mechanical contractor. Keeva Kekst, architect.

Spohn installs the low-cost pipe for waste lines, vents, heating and air conditioning piping

Good for the life of the building, steel pipe was used extensively in Cleveland's beautiful new Terrace Park Apartments. This 13-story beauty—a Marvin Helf, Inc., development—will contain 255 suites. Specified on the basis of overall savings, steel pipe was installed by Spohn Heating and Ventilating Company.

To save you time on the job, Republic makes every effort to produce pipe of the highest attainable quality. If it's galvanized, for example, you will find that every inch *is* galvanized, *is* welded, *is* sound, *is* round, *is* ready for installation. Contact your Republic distributor or call the nearest Republic sales office. You will receive quotes and confirmation within the day, perhaps within the hour. Republic sales offices are located in all principal cities. *Republic Steel Corporation, Department HP-2416, 1441 Republic Building, Cleveland 1, Ohio.*

Steel
Strong
Modern
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CALL FOR REPUBLIC PIPE

...MADE AND BACKED BY AMERICANS

REPUBLIC STEEL

YOUR ORDER MOVES AT CRANE

ANY STOCK VALVE ORDER—ANY SIZE—SHIPPED WITHIN 24 TO 72 HOURS!

Crane has put electronics to work on your valve orders. Crane's new high-speed order system links distributing and manufacturing centers with special telephone circuits, then uses punched tape and electronic computers to move any order for stock valves—however large—almost before the ink has dried!

Crane's newly-installed 100-million-digit-capacity computer also makes sure regular valves are in stock when you need them. It keeps track of more than 10,000 varieties of finished and semi-finished valves—38,000 different assemblies, sub-assemblies and raw materials. The punched tape that speeds the processing of your shipment within 24-72 hours also checks inventories automatically, and writes production orders to keep stock levels ready to meet any demand.

No one likes rush orders, but when they become necessary, you can count on Crane for even faster service.

For fast delivery of Crane precision-built valves, see your Crane Distributor or write Crane Co., Industrial Products Group, 4100 S. Kedzie Avenue, Chicago 32, Ill.

at the heart of home and industry

CRANE

valves
piping • electronic controls
plumbing • heating
air conditioning

The Honeywell Thermostat

MECHANICALLY NEW INSIDE...BEAUTIFULLY NEW OUTSIDE

FEWER WORKING PARTS

LOW-MASS SENSING ELEMENT

9 NEW FINISHES

Now offer your customers more accurate, more sensitive and more colorful temperature control.

Honeywell's simplified construction protects critical working parts in the base. A low-mass sensing element provides immediate response to temperature changes. The heavy gauge steel cover stands up to the toughest abuse. Seven finishes are electro-plated for lasting beauty—highly impervious to scratches and smudging. Two finishes are tough, baked-on enamel.

The new Honeywell Round is easier to read and set, too, with white numerals on a black background. With its new finishes, you and your architect can offer clients a wider choice —at no increase in cost!

Install Honeywell controls to assure your customers of the finest, smoothest heating and cooling.

Be sure you tear out the color chart on the next page to help you sell your prospects. For assistance on your next job, contact the Honeywell representative in your territory. ***Sales and service offices in all principal cities of the world.***

TEAR OFF AND SAVE!

LOOK AT ALL THE FINISHES YOU CAN OFFER!

SATIN CHROME. A brushed chromium plated surface. This finish supplied if no other specified.

POLISHED NICKEL. A bright, plated surface with a little softer tone than the polished chrome.

POLISHED CHROME. A bright chromium-plated surface, ideal for hospitals and other institutions.

SILVER BRONZE. A brushed silvery-bronze baked enamel surface with diamond luster coating.

STATUARY BRONZE. A rich, darker brushed bronze tone, plated. Heavy gauge steel cover resists abuse.

BOWER BARFF BLACK. A soft, black painted surface that adds a unique decorating touch.

BRUSHED BRASS. A soft, brushed golden brass color. Electro-plating keeps appearance years longer.

POLISHED BRASS. A gleaming golden-brass tone, plated. Virtually scratch-proof, smudges wipe off easily.

SATIN NICKEL. A brushed plated surface that is neutral in tone. All finishes resistant to corrosive atmospheres.

ONLY HONEYWELL DESIGNS, MANUFACTURES AND INSTALLS ALL THREE KINDS OF TEMPERATURE CONTROL—pneumatic, electronic and electric

Honeywell

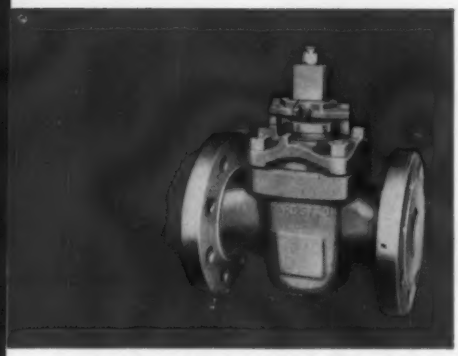
First in Control

SINCE 1885

WAREHOUSES Cleveland • Cincinnati
Chicago • New York (Long Island City)
Philadelphia • St. Louis

C. G. HUSSEY & COMPANY ▪ PITTSBURGH 19, PA.

DIVISION OF
COPPER RANGE COMPANY



seals tight: Let's get basic: The prime function of a valve is to shut off a line. And Rockwell-Nordstrom valves do this job better than any other valve on the market. They live longer, too, saving you money every year in valve replacement. The cost? No more than ordinary valves. Write for complete information.

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Peacock Brothers, Ltd.
Box 1040, Montreal, Quebec
Rockwell International, S.A.
81 Rue de la Servette
Geneva, Switzerland

Please send me Bulletin V-217.

Name_____

Company_____

Street_____

City_____ Zone____ State____

Youngstown Foundry & Machine cuts heating cost

Startling savings of $9,892 in fuel costs in one year's operation – plus a wonderful new kind of heating comfort – are big reasons Perfection Schwank *Gas* Infra-Red Heaters rate high with Youngstown Foundry and Machine Company, Youngstown, Ohio. Listen to these comments:

"Heating a 60 year old building like this is a tough job," states James Paumier, Plant Superintendent, "but this Perfection Schwank *gas* system gives us a constant and comfortable 65° temperature, drastically cuts our fuel cost and requires practically no maintenance."

Wayne Thew, Foreman, exclaims, "I've been here for 20 years and Perfection Schwank *Gas* Infra-Red is far superior to any other heating system we've tried. Castings and machinery are *always* the same temperature, eliminating expansion and contraction problems and making

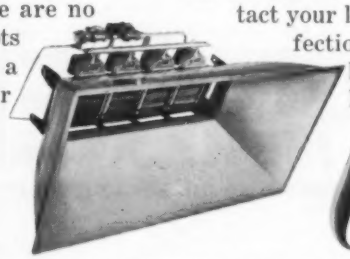
Part of the 41,160 square feet of floor space at Youngstown Foundry and Machine . . . all heated by Perfection Schwank Gas Infra-Red Heaters.

$9,892 with Perfection Schwank Gas Infra-Red Heaters

tolerances much easier to meet."

States Joseph Sagy, Plane Operator: "Since we've had these *gas* Infra-Red heaters, there are no drafts, no hot and cold spots . . . in every way they're a big improvement over our previous heating system.

Perfection Schwank *Gas* Infra-Red Heaters give you all of the advantages of modern *gas* heat—high efficiency . . . precise control . . . speed . . . safety . . . cleanliness . . . economy . . . as well as dependability of supply.



Heat better for less with Perfection Schwank *Gas* Infra-Red Heaters. For complete information, contact your local Gas Company or write to Perfection Division of Hupp Corporation, licensee of American Infra-Red Radiant Co., 1135 Ivanhoe Road, Cleveland 10, Ohio.

American Gas Association.

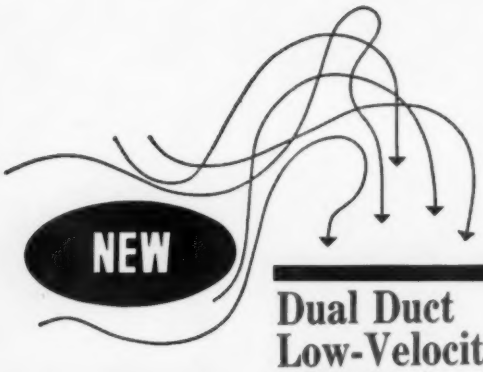
FOR INDUSTRIAL HEATING GAS IS GOOD BUSINESS!

Approved by A.G.A., Underwriters, C. G. A. and C. S. A.

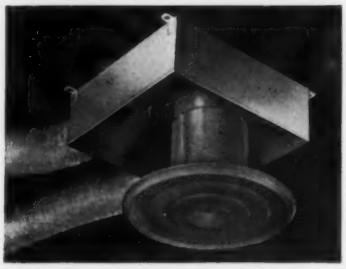
Under Schwank U. S. Patents 2,775,294 and 2,870,830 and pending applications.

Carnes is first to offer engineers and contractors a completely packaged low-velocity control unit specifically designed to meet the requirements of dual duct low-velocity systems. Carnes Low-Velocity ATC Units . . . where limited space does not demand the smaller duct size of high-velocity systems . . . offer all the advantages of individual room control inherent in dual duct air distribution systems. 2 ATC Ceiling Models — end discharge and bottom discharge in 5 sizes. 2 ATC Window/Perimeter Models — front and top discharge in 2 sizes.

LEADERS GO TO CARNES FOR THE NEWEST IN AIR DISTRIBUTION



Dual Duct Low-Velocity ATC Units



NOW DUAL DUCT COMFORT AT LOW-VELOCITY COST

Carnes Low-Velocity Acoustic Terminal Control Units — ATC — provide "pinpoint" temperature control for specific zones through the flexibility of dual duct air distribution without the need for sealed ducts, high pressure fans and high fan horsepower. Carnes Low-Velocity ATC Units proportion the hot and cold air in response to individual room thermostats . . . blend the hot and cold air for discharge to individual space areas . . . attenuate self-generated noise plus duct-carried noise . . . provide manual volume adjustment.

For complete information, write for Carnes Low-Velocity ATC Catalog 1361.

Carnes also manufactures: High-Velocity ATC Units • Modular, Round, Rectangular, Square, Convertible and Baseboard Diffusers • Registers • Grilles • Roof and Wall Ventilators.

CARNES CORPORATION, VERONA, WISCONSIN, / CANADIAN SUBSIDIARY: WEHR AIR EQUIPMENT COMPANY, LTD., 86 GERTIE STREET, WINNIPEG 2, CANADA

Bethcon galvanized steel sheets permit long spans, minimum supports

Strong and rigid—because they're steel—Bethcon galvanized sheets form up into strong and rigid ductwork which requires a minimum number of supporting brackets.

In addition, a Bethcon galvanized steel sheet is just right for easy shopwork . . . not too hard, not too soft. That's because we use a special annealing cycle which gives the sheet an ideal balance of ductility and strength.

Bethcon's zinc coating is second to none for its refusal to flake or peel off. Bethlehem's continuous galvanizing process bonds zinc to steel so tightly that even when the sheet is doubled back on itself, the coating stays put. Hemming without puckering or wrinkling is no problem with Bethcon sheets.

You can specify Bethcon galvanized sheets in a wide variety of gages, with either plain open-hearth or copper-bearing (Beth-Cu-Loy) steel for the base metal. We'll be glad to furnish any details you need. Just get in touch with our nearest sales office.

Galvanized Steel

for Strength
. . . Economy
. . . Versatility

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

Export Sales: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL

HW HR HSH

DIAMOND BITS DESIGNED TO DRILL THROUGH ANY AGGREGATE USED IN YOUR LOCALITY

Reinforced concrete, marble, quartz, tile .... all masonry materials.... drilled efficiently and rapidly to produce the "LOWEST COST PER HOLE" when using MOLCO Diamond Drill bits, hole size diameters from 3/16 to 14".

Two new series of Diamond Bits.... the HR & HW....supplement the present line of HSD and HSH series bits, to give the widest range of bits available on todays market. New standards of engineering and design have produced outstanding drilling qualities to give you maximum return on each equipment dollar invested.

MOLCO DRILLING MACHINES, INC. • **909 FRANKLIN ST. N.E. WASHINGTON 17, D. C.**

NOW! Honeywell licks the washing problem in electronic air cleaning

Exclusive Flutter-Jet washing system forces water all the way through to wash away dirt automatically . . . eliminates breakdowns . . . makes a cleaner virtually trouble-free

Efficient washing is the key to efficient air cleaning. But up until recently, nobody was able to come up with a positive, trouble-free washing system.

Now Honeywell engineers have licked this problem once and for all.

Honeywell's exclusive Flutter-Jet washing system does the job thoroughly and automatically. Gone are the problems of breakdown, poor efficiency and high maintenance that have plagued air-cleaning systems in the past.

Removes dirt with a blast of water

A powerful jet-stream of water shoots out of a flexible hose which whips up and down at a rapid rate. This throws thousands of jets of water in, on and through the collection plates. The manifold, moving back and forth, sweeps the area completely, washing every corner.

JETS PENETRATE WHERE SPRAY CAN'T

Mounted on moving manifold, Honeywell Flutter-Jets whip up and down. Blast jets of water all the way through dirty air cleaner plates. Ordinary nozzles tend to fog. Their thin spray fans out. Can't penetrate or clean as jet-streams do.

Honeywell's Flutter-Jet washing system includes five cycles of Jet washing. A final spraying of adhesive can also be supplied when necessary to allow the dirt to be washed off more easily in the next wash.

Unlike other washing systems with spray-type nozzles, Flutter-Jet cannot fog the water or clog, which reduces cleaning power and adds to maintenance.

Already in operation for well over a year in many buildings, the trouble-free operation of Honeywell's electronic air cleaner with Flutter-Jet washing is a matter of record (available just by writing for it).

Before you design the air conditioning for your next building, check into Honeywell's air recovery system, with exclusive Flutter-Jet washing action. Installation is easy, 4 models to choose from to fit every requirement. Service is as close as your client's phone. And, if you want more details, call the nearest Honeywell office—112 throughout the country. Or write Honeywell, Dept. HP-8-154, Minneapolis 8, Minnesota.

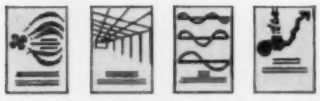
HONEYWELL INTERNATIONAL. Sales and service offices in all principal cities of the free world. Manufacturing in the United States, United Kingdom, Canada, Netherlands, Germany, France, Japan.

Honeywell

First in Control

SINCE 1885

how to overcome basic heating problems



FREE FROM REZNOR:
Four new "Reznor Heating Handbooks" to help you solve common and uncommon problems in commercial and industrial heating.

In these new handbooks, published by the manufacturer of the world's largest selling gas unit heaters, you'll find the latest information on how to use unit heaters and duct furnaces most efficiently in industrial and commercial installations. Also discussed are such problems as how to design a make-up air system, how to control temperature with direct fired unit heaters, and how to use duct furnaces in heating-cooling systems.

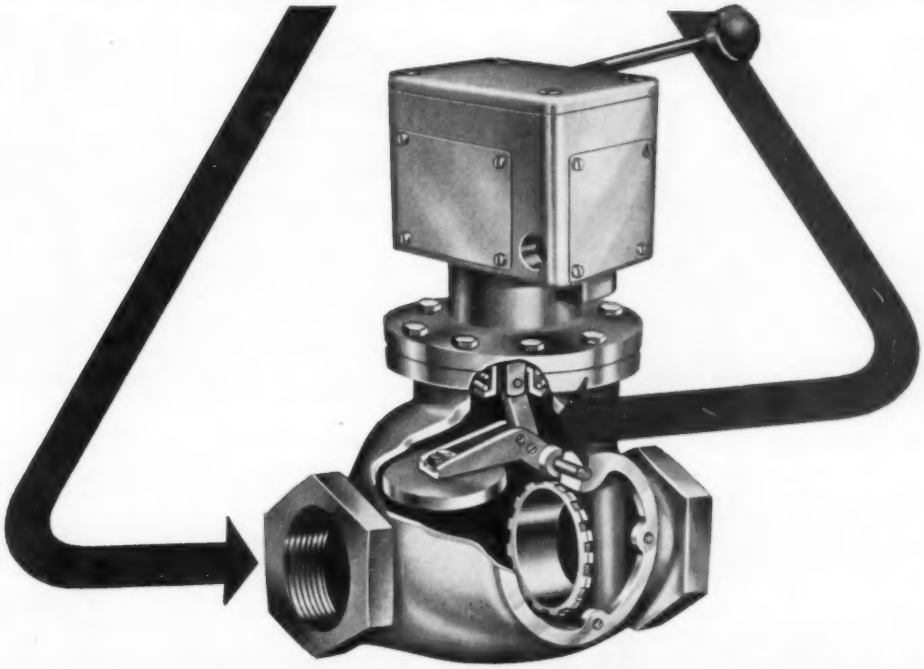
We think you'll find these handbooks valuable as basic working tools. To receive your copies, call your Reznor full-service distributor or nearby district office listed in the Yellow Pages under "Heaters—Unit." Reznor Manufacturing Co., Dept. HPA-8, Mercer, Pa.

REZNOR HEATERS

K-1385

Which of these major gas valve problems is yours?

CAPACITY? SAFETY?



THIS NEW GENERAL CONTROLS HI-FLO GAS VALVE SOLVES BOTH... AND MORE

Straight through flow provides maximum capacity – minimum pressure drop. Vertical seating prevents build-up of foreign matter on valve seat, and soft seat ensures positive shutoff. Short 90° travel reset handle for easy opening *and* closing, manually. H-117 model incorporates dual release actuator, and fixed or adjustable opening speeds. Before you buy *any* high capacity gas valve, check this capacity table. You'll find your nearest General Controls factory representative in the yellow pages.

GENERAL CONTROLS

Automatic Controls for Heating or Process
Glendale, Calif. • Skokie, Ill. • Boston, Ontario, Canada
Nine plants and Factory Branch offices serving the United States, Canada and Western Europe

COMPARE THESE GAS CAPACITIES

GAS CAPACITY – 1" DROP

PIPE SIZE (INCHES)	HI-FLO VALVE			CONVENTIONAL GLOBE VALVE
	CU. FT. HR.	MAX OPER. PRESS P.S.I.	Cv FACTOR	CU. FT. HR.
1 SCR	2000	50	37.8	920
1¼ SCR	2700	50	51.0	1370
1½ SCR	4000	50	75.6	1840
2 SCR	8000	25	151.0	3570
2½ SCR	12,900	15	244.0	4500
3 SCR	17,000	15	320.0	6600
4 FLG	27,000	8	510.0	8900
6 FLG	54,000	5	1020.0	17,800

CHOICE OF TWO ACTUATORS:

V-116 MANUAL RESET, with lever action—90° handle travel. Held open electrically, spring closed on power interruption.

H-117 HYDRAMOTOR, electric reset, with either fixed opening speed or adjustable opening speed regulated to design of equipment.

O-B Valves

withstand continuous "stop-and-go"

...in high-temp. steam lines

Frequent operation and constant throttling of steam up to 550° F. present none of the usual hazards of wear when O-B valves like No. 1401 (pictured) are used. Renewable stainless steel plugs and seats are also ideal for accurate control of air, water and oil. They withstand excessive service demands.

...in air-handling applications

Plants requiring continual on-and-off operation in air handling applications will do well to consider O-B globe valves with soft disc designed for tight shutoff and long service life. Excellent also for water, oil, gas and gasoline applications. Easily repacked under pressure.

...in dry cleaning equipment

Fast, positive action for users of dry cleaning, pressing and laundering equipment is assured by this quick-opening lever type globe valve. Soft composition disc provides leak-tight shutoff . . . hard disc is also available. Discs can be replaced without removing valve. Sizes from ¼" to 1".

...in domestic water systems

Strong solder joints that resist high temperature, vibration and corrosion are easily obtained with No. 2800 (above) and other O-B gate valves designed for copper-to-copper applications. Use also in steam, air, oil and gas lines. They can be repacked under pressure with disc in full open position.

You'll find it pays in unexpected ways to ask for "O-B" bronze valves. Good functional design, high-strength components, and features not found in all standard and low-pressure valves are common to the entire O-B line. Write for latest catalog information.

OHIO BRASS COMPANY • Mansfield, Ohio

Ask your distributor for the valve in the orange-and-black box

Some Straight Talk On Steam Trap Capacity

...or pulling away the curtain of confusion that surrounds steam trap capacity ratings.

Unfortunately, for the steam trap buyer, the subject of steam trap capacity has become cloudy and confused by a landslide of claims, counterclaims and inconsistent "standards" for measurement. So let's take a cold hard look at this subject so vital to the efficient operation of your plant.

What Determines Steam Trap Capacity?

There are three factors that determine the capacity of a steam trap:

1. The area of the orifice.
2. The density of the condensate.
3. The pressure differential across the trap.

Let's take a closer look at each of these:

Area of orifice is usually specified by the trap manufacturer or can be calculated from the diameter. Nothing complicated here.

Density of condensate depends on temperature. A cubic foot of cold water weighs 62.4 lbs. At 250° F. or 15 psi, it weighs less than 59 lbs. This is important. Don't overlook it.

Pressure differential across the trap is most significant. And it is complicated by the many factors that affect it, such as:

1. Pressure drop between unit drained and the trap when the trap valve is open.

2. Distance the trap valve is moved from the valve seat.

3. Back pressure on the trap with orifice closed; i.e., return header pressure.

4. Increase in back pressure produced by condensate and flash steam flowing in the discharge line. This in turn is affected by the diameter and length of the discharge line, plus friction caused by valves and fittings.

Orifice Capacity Vs. Steam Trap Capacity

Figure 1 shows a ½" diameter sharp-edged orifice at the end of a pipe filled with cold water at 15 lbs. pressure. The capacity of this orifice, using a .61 coefficient of flow would be 8,800 lbs. per hr. Now, would this ½" orifice if used in a ¾" steam trap installed as shown in Figure 2 provide the trap with a continuous discharge capacity of 8,800 lbs. of hot condensate per hour? The answer is "no". And here are some of the reasons why:

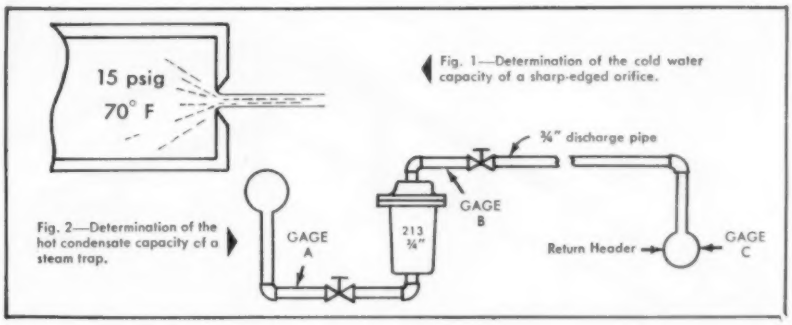


Fig. 1—Determination of the cold water capacity of a sharp-edged orifice.

Fig. 2—Determination of the hot condensate capacity of a steam trap.

Density of condensate. As pointed out above, cold water weighs 62.4 lbs. per cu. ft. At 15 lbs. pressure and 250° F. water weighs less than 59 lbs. per cu. ft. This difference in density alone reduces the lbs. per hour capacity of the orifice by over 5%.

Pressure differential across the trap. With the trap valve closed we have a static pressure differential of 15 psi. The trap valve must be able to open against this pressure. However, this is not the pressure differential that will determine the capacity of the trap valve.

The ¾" discharge line will be full of a mixture of flash steam and condensate. To keep this mixture flowing from the trap outlet to the return line requires a pressure differential. In actual capacity tests run as shown in Figure 2 Gage B at the trap outlet registered 11 lbs. back pressure. Thus the true pressure differential across the trap was about 4 lbs. Under these conditions the measured capacity of the trap was 4,340 lbs/hr. or just about half of the capacity of the ½" orifice for cold water.

How Armstrong Determines Capacity Ratings

Armstrong trap capacity ratings are based on hundreds of tests under actual operating conditions. In these tests, the condensate used was at the steam temperature corresponding to the test pressure. Thus, the capacities determined take into account the pressure drop that occurs when the trap orifice opens and the choking effect and back pressure of the flash steam. Actual installation hookups were used so that pipe friction in both inlet and discharge lines as well was reflected in the results.

Let's go back to the example cited above and in Figure 2. The trap referred to is an Armstrong No. 213. While it did test out at 4,340 lbs. per hour for a static pressure differential of 15 psi, it is rated in the catalog at only 3900 lbs. per hour for this pressure—just to be on the safe side.

For the trap buyer, this means that Armstrong Steam Trap capacities are based on handling condensate at steam temperature for the stated static steam pressure differential under actual working conditions.

Capacity ratings which don't take into account all of the variables will be misleading and may lead to the selection of undersized traps. So whenever you specify or buy traps be sure that the capacity ratings you work from are realistic. One way to be sure is to select Armstrong Traps with *guaranteed* capacity ratings.

* * *

Additional information on trap capacity ratings, plus data on how to correctly size, install and maintain steam traps for any pressure, any temperature and any load, are presented in the 48-page Armstrong Steam Trap Book. Ask your local Armstrong Representative for a copy or write:

Armstrong Machine Works
8741 Maple Street
Three Rivers, Michigan

ARMSTRONG STEAM TRAPS

See our Catalog in Sweet's Industrial Construction File.

FLUOR COOLING TOWERS

*

Fluor Cooling Towers are the result of over 40 years of cooling tower experience. Designed for central station air conditioning and industrial requirements, Fluor Towers provide more service at lower cost, and longer tower life under all operating conditions.

For more information on Fluor Cooling Towers, write for our descriptive brochure.

higher performance

lower maintenance cost

built-in permanence*

Fluor PRODUCTS COMPANY COOLING TOWERS

FOUNDER MEMBER CTI COOLING TOWER INSTITUTE

A division of The FLUOR CORPORATION, Ltd.

GENERAL OFFICES: P. O. Box 1267, SANTA ROSA, CALIFORNIA

Armaflex sheets . . . the faster, better way to insulate large fittings

Contractors save time when they use Armaflex foamed plastic sheets to insulate large fittings in the sub-zero to 200F range. Armaflex sheets often can be installed at lower costs than conventional insulations, too, and they do a more efficient job. They are easily cut for accurate fit, quickly positioned and secured with Armstrong Adhesive at the joints, need no mechanical support, and are vaporproof. The completed installation has a clean, professional look, and cleanup can be done quickly with a dustpan and broom.

Armaflex sheets are one of a complete line of Armstrong products, including flexible Armaflex 22 Pipe Covering, Rigid Armaflex for compression resistant application, and Armaflex Finish and Adhesives for a neat and permanent job. For complete product information and specifications, write today to Armstrong Cork Company, 2208 Sherman Street, Lancaster, Pennsylvania.

Armstrong INSULATIONS

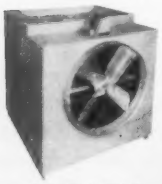
ARMAFLEX 22 • RIGID ARMAFLEX • SHEET ARMAFLEX • ARMAFLEX FINISH • ARMAFLEX ADHESIVES

want to

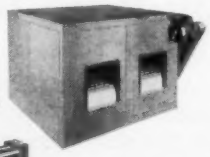
save on job costs?

specify these dependable Halstead & Mitchell products:

PRODUCT	SERIES	TYPE	NOMINAL TONS	WRITE FOR BULLETIN
COOLING TOWERS with an exclusive 20-Year Guarantee on the wetted deck material against failure due to fungus attack or rotting.	EC	Standard • Propeller fan • Belt drive	5 to 150	EC-500
	ECK	Take-Apart • Propeller fan • Belt drive	5 to 100	EC-500
	ECD	Residential • Propeller fan • Direct drive	2 to 7½	EC-500
	ECKB	Standard or Take-Apart • Centrifugal fan • Belt drive • Horizontal or Vertical discharge	5 to 30	ECKB-601
WATER-COOLED CONDENSERS Mechanically cleanable, condensers are of double-tube, true counterflow design for extra liquid subcooling.	EL	Standard for small commercial refrigeration	⅓ to 3	WC-300
	WR	Multi-Section for larger commercial refrigeration	2 to 7½	
	R	Close-coupled for packaged air conditioning	1½ to 10	
	T	Heavy duty for poor water conditions	⅓ to 25	
	SW	Sea water and corrosive water usage	⅓ to 25	
AIR-COOLED CONDENSERS Wide fin spacing won't clog quickly. Casings are rugged; won't rattle or loosen. Use with a Limitrol valve for year-round operation. Multiple circuiting at no extra cost.	AC	Propeller fan • Horizontal discharge • Belt drive	3 to 100	AC-102
	ACV	Propeller fan • Vertical discharge • Belt drive	5 to 100	
	BC	Centrifugal fan • Belt drive	10 to 30	
	ACR	Residential model • Centrifugal fan • Cabinet has space for compressor and controls	2 to 7½	
FINNED COILS Turbu-Flo® fins for better air wash. Aluminum fins, copper tubing. (Copper fins to order.) Heavy-gauge galvanized steel casings (or aluminum). Cleanable tube water coils to order.	DE	Direct expansion coils for Refrigerants 12, 22 and 500	Standard is 7 fins per inch. Available in 6, 8, or 10 FPI on order. Finned heights of 12 to 36 inches. Finned lengths of 18 to 120 inches. 1 to 8 rows deep. Other sizes to order.	DE-200
	CWC	Chilled water coils		CWC-202
	HWC	Hot water coils		HWC-201
	S	Standard steam coils		S-200
	NFS	Non-freeze steam coils • Steam distributing tube type		
AIR HANDLERS Large centrifugal fans in a heavy-gauge cabinet of formed post members, flush mounted panels. Space for up to 12 rows of coil depth; 2 to 68 sq. ft. of face area.	AH	Suspended type	3 to 120 tons at std. conditions of 880 to 47,500 CFM at 400 to 700 FPM; up to 2" W.G.	AHU-100
	VAH	Floor mounted type		



COOLING TOWERS



AIR HANDLERS

WATER-COOLED CONDENSERS

AIR-COOLED CONDENSERS

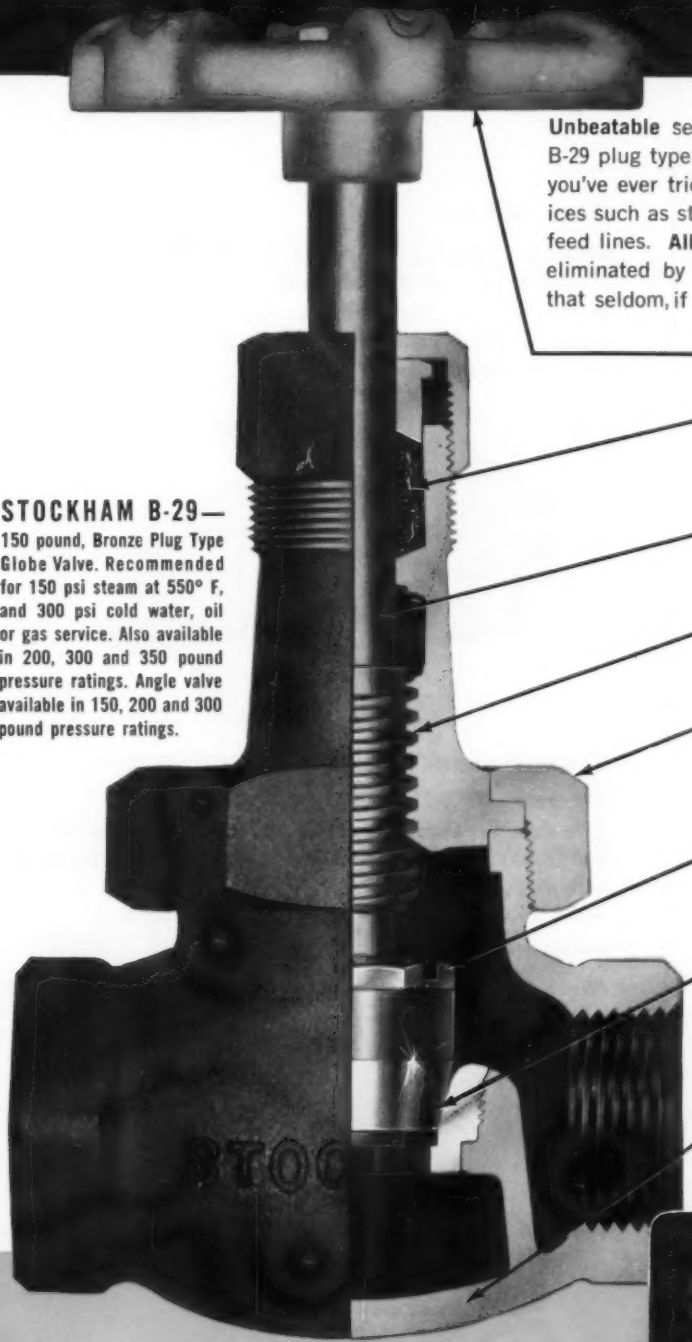
FINNED COILS

HM Halstead & Mitchell

HALSTEAD & MITCHELL CO. · BESSEMER BUILDING · PITTSBURGH 22, PA.

TRY ONE ON YOUR TOUGHEST SERVICE

and discover what dependability means...



Unbeatable service is built into **every** feature of Stockham's B-29 plug type bronze globe valve. It will **far outlast** any valve you've ever tried... even in the most severe valve-killing services such as steam throttling, drain or blow-off lines and boiler feed lines. **All** the common causes of valve failure have been eliminated by amazingly superior alloys and design features that seldom, if ever, need maintenance of any kind. Examples...

HANDWHEEL
Easy grip, non-slip, non-heating.

STUFFING BOX
Extra deep design, completely machined, accommodates more packing for tighter seal, longer packing life and less repacking. Can be repacked under pressure in full open position.

BESTALOY STEM
Extra large diameter aluminum-silicon bronze alloy stem is by far the longest wearing in the industry.

STEM THREAD ENGAGEMENT
Extra heavy acme stem threads and complete stem thread engagement assure maximum stem life.

UNION BONNET
Rugged, heavy duty body-bonnet connection, best type to resist line strain and give added strength for severe operating conditions. Easiest type to dismantle and reassemble, without danger of injury to body-bonnet bearing surfaces.

DISC LOCKNUT
Made of hardened stainless steel, far superior to bronze. Highly resistant to abrasive wear caused by disc rotation; offers maximum corrosion resistance.

STAINLESS STEEL PLUG TYPE DISC & SEAT
Heat treated to 500 Brinnell hardness for maximum resistance to galling, abrasion or wire drawing. Can be reground or renewed. Tapered plug type design best for steam throttling and close regulation. Far superior to flat type disc design.

BODY
Designed for minimum pressure drop. Extra heavy ribbed design gives maximum resistance to line strain.

STOCKHAM B-29—
150 pound, Bronze Plug Type Globe Valve. Recommended for 150 psi steam at 550° F, and 300 psi cold water, oil or gas service. Also available in 200, 300 and 350 pound pressure ratings. Angle valve available in 150, 200 and 300 pound pressure ratings.

STOCKED BY YOUR LOCAL STOCKHAM DISTRIBUTOR

Bronze, Cast Iron, Ductile Iron, Cast and Forged Steel Valves — Wedgeplug Non-Lubricated Plug Valves — Cast Iron, Malleable and Ductile Iron Pipe Fittings

STOCKHAM
VALVES *and* FITTINGS

General Offices and Plant
4000 10th AVENUE, NORTH • BIRMINGHAM, ALABAMA

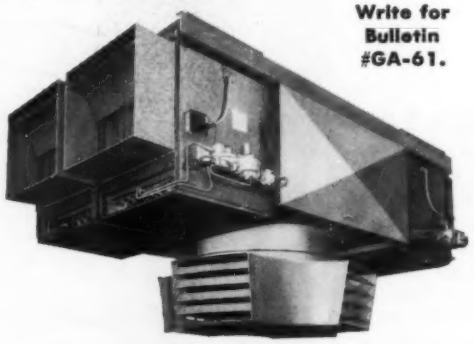
YOU CAN'T GO WRONG SPECIFYING WING GAS FIRED HEATING AND VENTILATING EQUIPMENT

It's fact. New plant or old plant heating and ventilating modernization needs are best handled with Wing gas fired equipment. Proved: high efficiency performance, fuel economy, ease of installation, service dependability, and long life with low maintenance make Wing heating and ventilating equipment first choice of most quality conscious engineers. Be right — always specify Wing.

Gas Fired
Duct Heater Assemblies

Six downblow models. Coverage up to 145' sq. Capacities from 320,000 to 1,200,000 Btu/hr. Mounting heights to 65 feet. 4 fixed and 4 revolving discharge outlets available. AGA approved components.

Write for Bulletin #GA-61.



Gas Fired
Fresh Air Supply Heaters

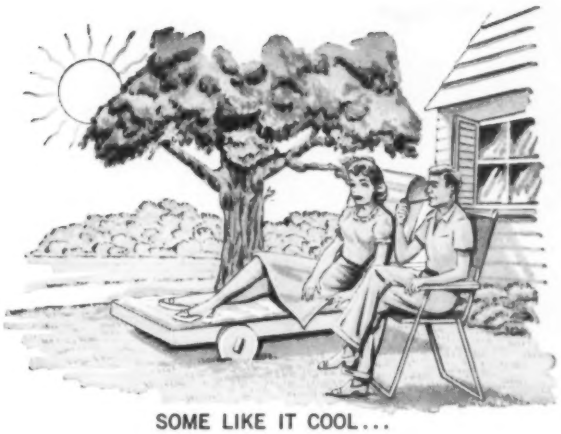
Five sizes. Capacities from 1,500,000 to 4,500,000 Btu/hr. and 15,000 to 50,000 CFM. Horizontal or vertical air discharge with wall or roof inlet. 6 fixed and 3 revolving discharge outlets available.

Write for Bulletin #GFAS-60.

L. J. WING MANUFACTURING CO.
DIVISION OF AERO-FLOW DYNAMICS, INC.
140 VREELAND MILLS ROAD, LINDEN, NEW JERSEY
WC161 FACTORIES: LINDEN, N. J. AND MONTREAL, CANADA

WING

SOME LIKE IT HOT...

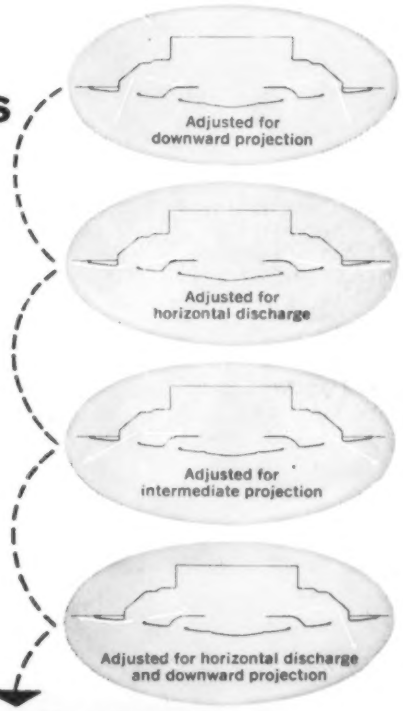


SOME LIKE IT COOL...

AGITAIR® solves these air distribution problems

with the

TRULY ADJUSTABLE Diffusers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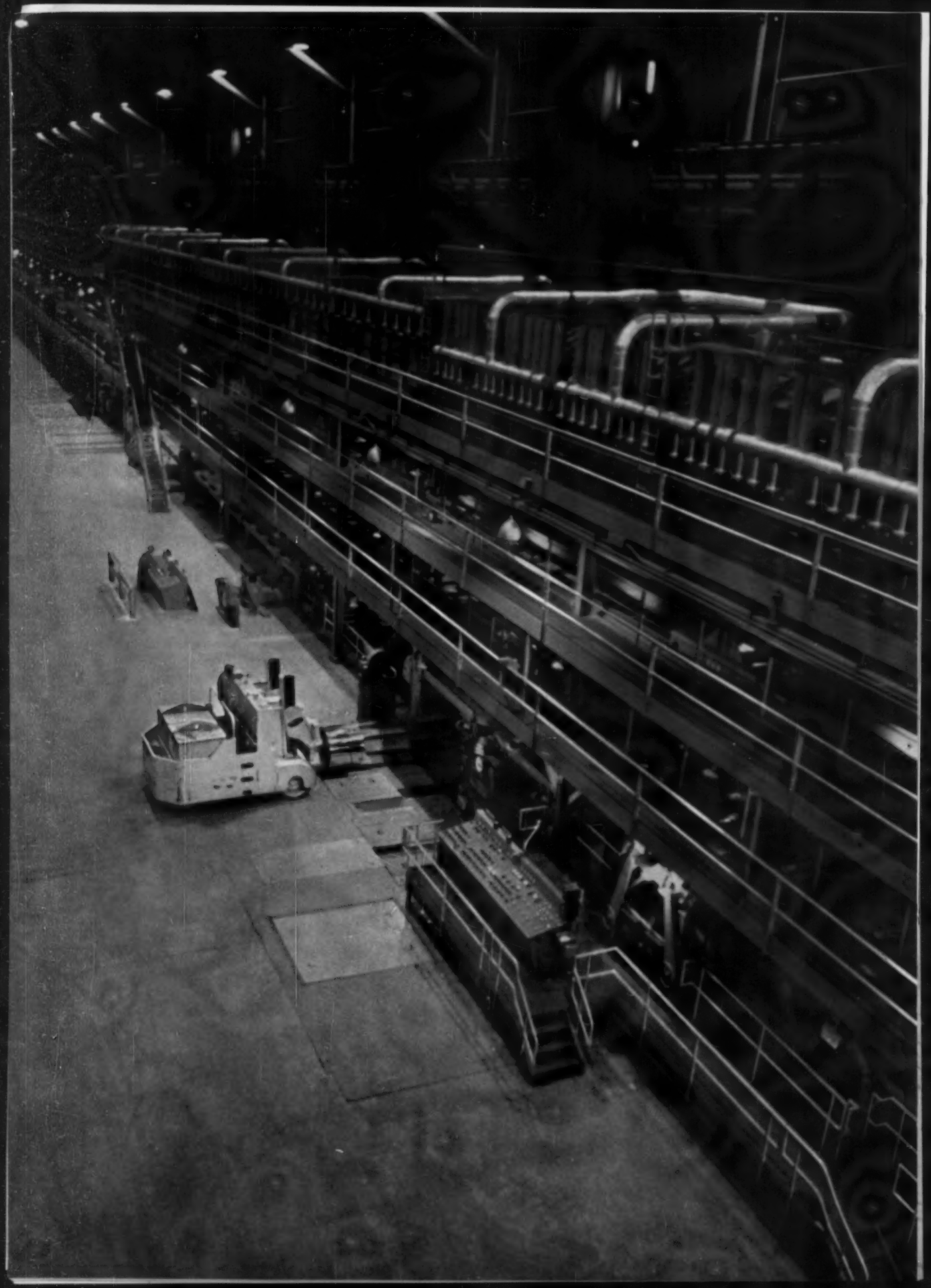

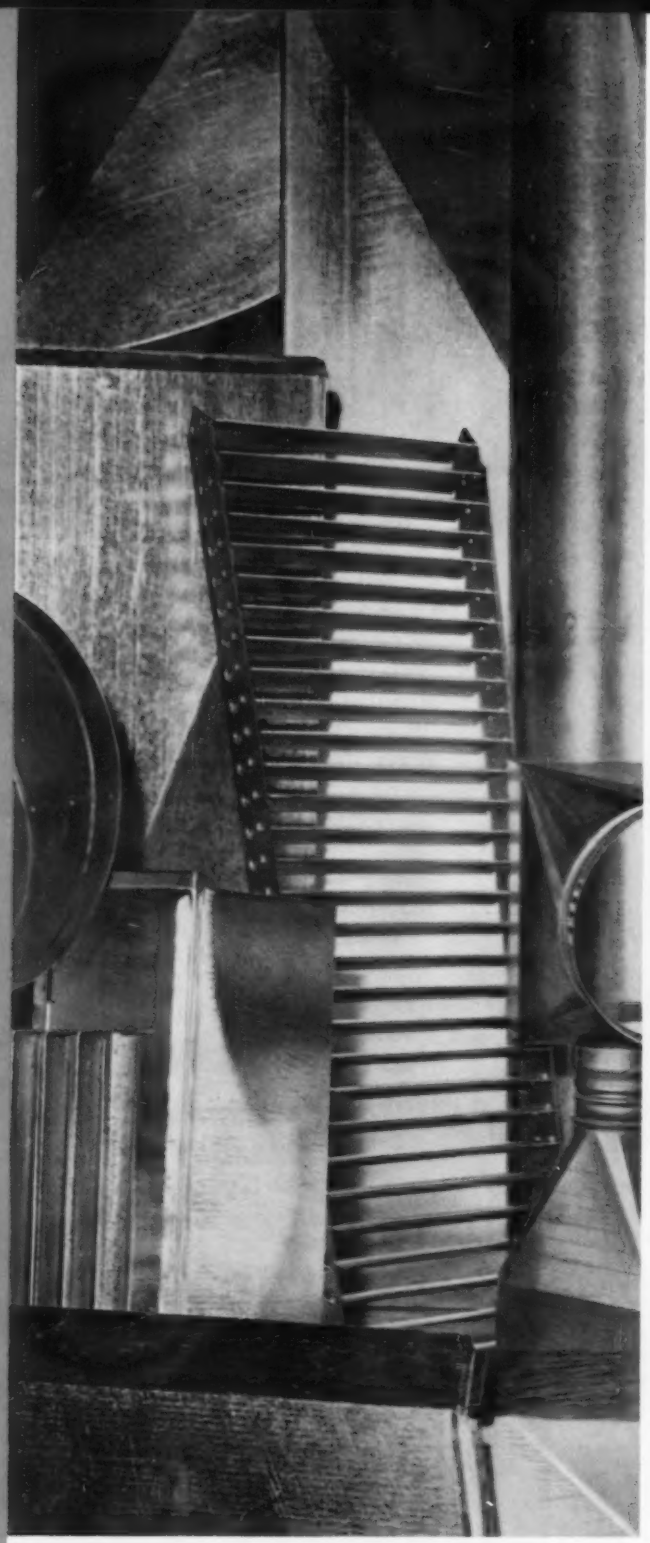

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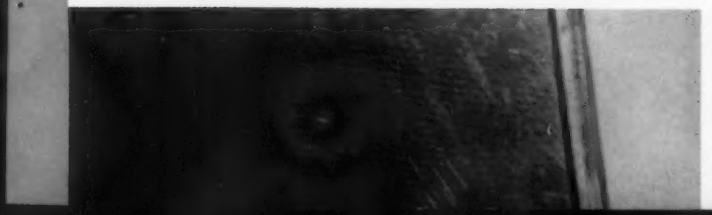
Youngstown – growing force in steel



For full details on Youngstown **tufkote** galvanized sheet, write: Dept. 10-C
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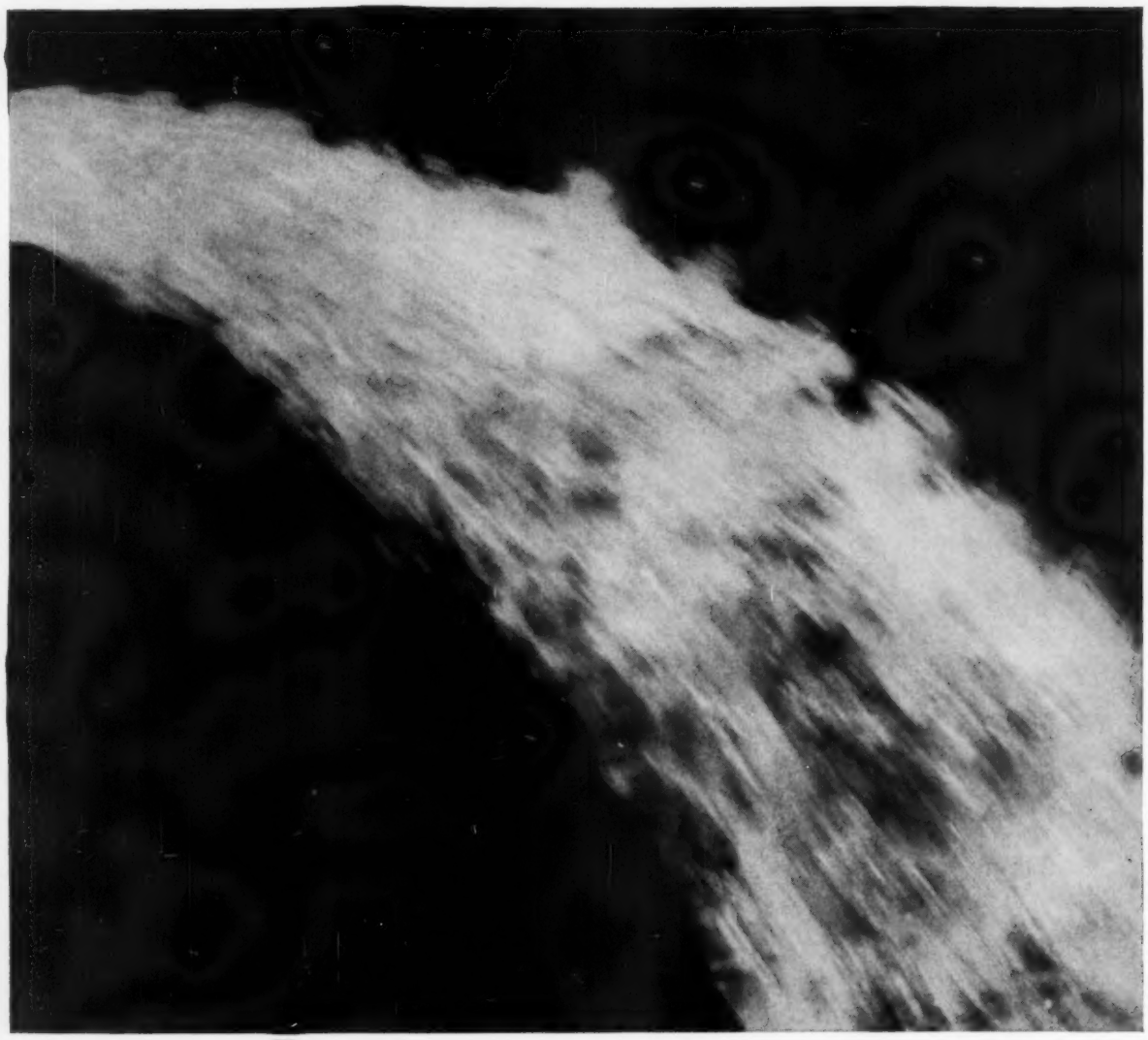

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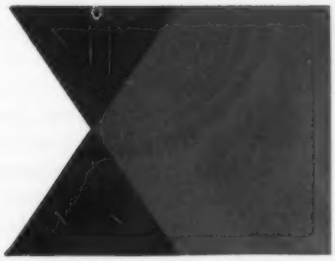
We follow here each month the practice at engineering society meetings of providing an "open for discussion" period. You are urged to take part. Just address your comments to the Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.



"Open for Discussion"

Added Thoughts on "Meddling" With Department Store Air Conditioning

THE ARTICLE *Negative Pressure in an Air Conditioned Building*, by Joseph H. Jerrell, in the July issue is very well written and applies to many large buildings, particularly department stores. Mr. Jerrell explained several situations that occur too frequently, namely

1) Construction on some buildings is virtually never completed due to frequent additions and changes. Revision of the air conditioning system to correspond with each small change in the building often is neglected. Besides the addition of exhaust systems, the following items can upset the operation of an initially well-designed system.

a) Installation of escalators
b) Revision of partitions
c) Added lighting intensity
d) Additional equipment and employees
e) Orders to disregard the designer's operating instructions

2) No particular one of a number of small changes is responsible for upsetting the proper functioning of a system. The cumulative effect of all the changes is responsible.

3) Management decides to save money by eliminating engineering in connection with minor alterations, and creates an additional problem for each one that is solved.

4) Unnecessary further complaints are introduced by " cut and try" methods of correcting the problems caused by lack of alteration of the air conditioning system. These methods involve no expense.

A question and answer might well be added to Mr. Jerrell's excellent article. *Question*: Who is considered responsible for unsatisfactory operation of the system? *Answer*: Frequently the operating engineer or the original designer.

R. A. PARSONS
Board of Water & Light
Lansing, Mich.

Wants Additional Information on Albuquerque Bank Air Conditioning

I HAVE READ the article, *Engineers Raise The Roof To Heat, Cool Albuquerque Bank*, by Roger W. Haines in the April issue of HPAC and find it quite interesting.

I would like to comment as follows, however, as it would be helpful to me if the following were answered:

1) I notice there is no radiation located below windows and in some cases these windows are 16 ft high. As the design data for Albuquerque is approximately the same as New York, I am wondering whether any down drafts, due to cold air cascading down the glass areas, would overcome the effect of the return air located under the windows.

2) There is no mention of humidity control for winter.

3) Was there any investigation made for the use of evaporative cooling when the outdoor weather conditions are favorable?

VINCENT A. BIANCULLI
Syska and Hennessy, Inc.
Consulting Engineers

THE AUTHOR'S REPLY — We agree with Mr. Bianculli that radiation is usually desirable under win-

"Open for Discussion"

Continued

dows. We have found, however, that it is not necessary in our mild climate except for very large glass areas. The 16 ft windows on the first floor of this building are provided with an air blanket from sill supply grilles which prevents any cold down drafts very effectively. In this connection, while minimum winter design dry bulb temperatures for Albuquerque and New York are similar, our average daily temperature is usually in the high 30's or low 40's even in extreme weather. This, combined with our high percentage of sunshine, minimizes the need for supplementary radiation in office buildings.

We do not normally provide humidity control in this area. Due to the prevalent low outdoor relative humidities we will seldom exceed 40 percent RH in an air conditioned building in summer, and it is probably more like 10 to 20 percent in winter. Since the residents are acclimated to these humidities, no problems arise. But, with daytime humidities of 8 to 10 percent usual in summer, new residents have a difficult time for a few weeks. The maximum humidity even immediately following a rainstorm seldom exceeds 75 percent.

Because of these low humidities, evaporative cooling is attractive. We did not use it on this job, but we frequently specify sprayed coil units, not for humidity control, but to use the evaporative cooling function in spring and fall to cut down on compressor operation. We cut off the sprays during hot weather. This type of arrangement is being used on the new Fine Arts Building at the University of New Mexico. Here it is particularly desirable, since chilled water is supplied from a central plant and is not always immediately available when needed.

I would like to thank Mr. Bianculli for his comments and hope this answers his questions.

ROGER W. HAINES
Bridgers & Paxton
Consulting Engineers, Inc.

Some Alternate Ideas for Cooling Data Processing Machines, Spaces

I HAVE READ the article, *New Design Approach Traps High Internal Heat Loads,* by F. J. Grande in the June issue, and wish to make several comments on it.

We installed a similar system in a Data Processing Center a year ago at our Peoria facility, and the results have been very gratifying.

Our internal loads approach 30 tons, and we circulate a total of 12,000 cfm. Three modified 15 ton self-contained units are located outside the area, one of the units being used as a "spare." A manual sequencing switch, which is set at the beginning of each week, assures the equal use of all three units on the system. The "spare" unit guarantees design conditions in the Center should one unit be down for maintenance.

We also use the raised floor as the supply air plenum. However, since we were specifically warned not to introduce this air below the high heat producing machines because of its high moisture content, all of the supply air is introduced at the periphery of the room through floor registers.

The space above the paneled suspended ceiling is used as a return air plenum. Return air registers are concentrated above the machines, and can be moved when necessary to accommodate changes in machine locations.

Conditions within the Center are recorded at all times. Generally, the dry bulb is being maintained at 74 F while the relative humidity will vary between 35 and 40 percent.

H. P. KAULFUSS
Staff Engineer
Peoria Plant Engineering
Caterpillar Tractor Co.

Wants Adjacent-Area Temperature Data On Garage Air Curtain Door

WE ARE very much interested in the article *Unusual Air Curtain Doors Serve Garage* by C. F. Mowrey in the May issue, particulary since the operation has been so satisfactory. We would like to study temperature readings in the area of the plant just inside the doors to a distance of about 30 ft from the doors during winter operations.

If the author could obtain these readings during normal winter weather, we think they would be very valuable.

JOHN H. ROSS, *P. Eng.*
John H. Ross and Associates, Ltd.
Consulting Engineers

THE AUTHOR'S REPLY — The purpose of the air door installation, utilizing an air current, was to prevent too low a temperature drop during the cold weather, and to facilitate and improve safety and traffic flow.

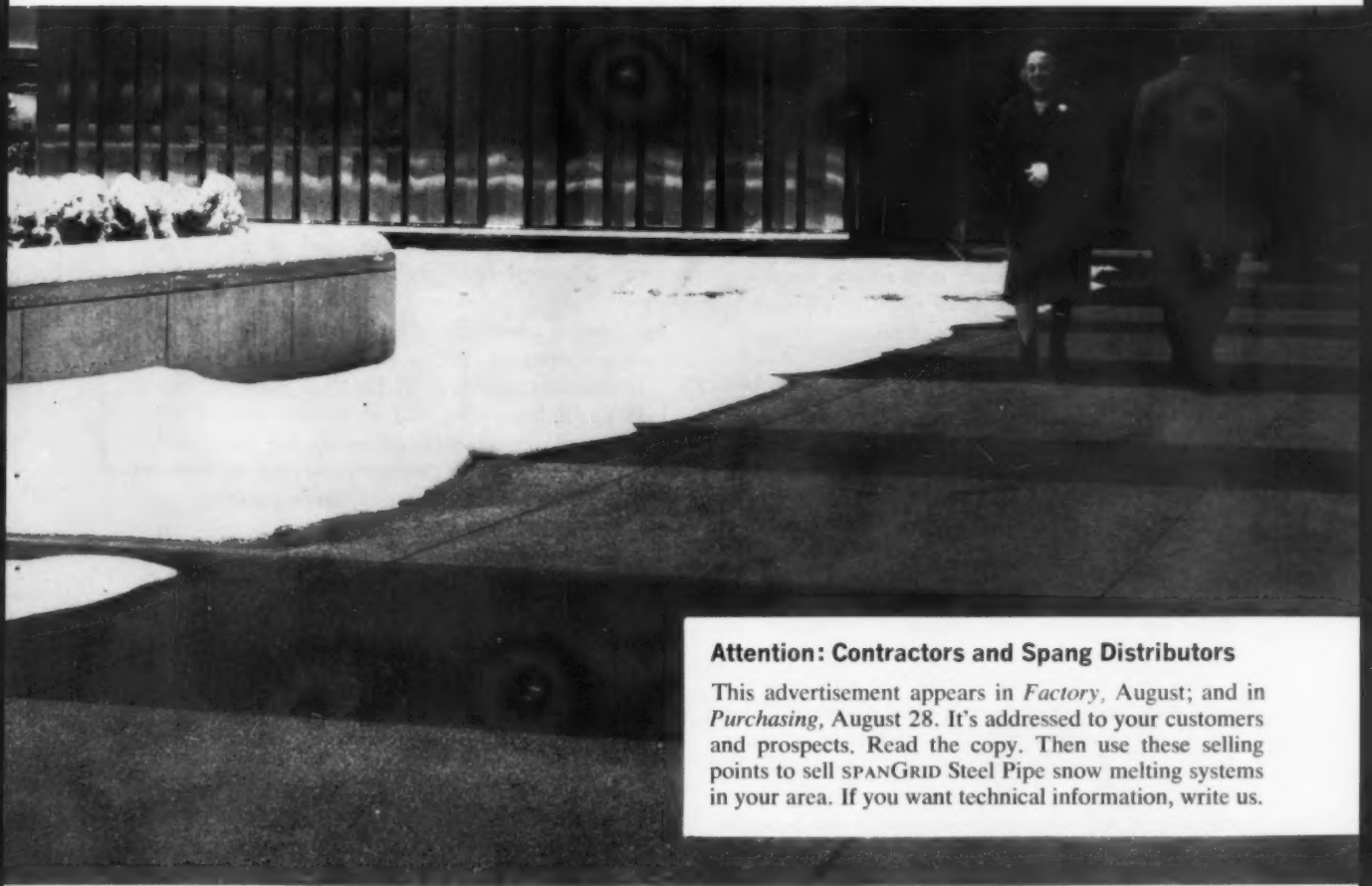
Since these conditions were all improved, no temperature measurements were taken. When previously the doors were opened and closed only to allow traffic flow when necessary, the resulting temperature in the vicinity of the doorway was often very much lower than in the garage proper, which was normally maintained at an average of 75 F.

Although we found that during cold weather the air curtain doors could not always prevent the temper-

Continued on page 82

END THIS... Removing snow by shoveling, or with salt, chemicals or cinders costs you money. It ties up manpower which could be used more productively. And you run the risk of over-exertion or injury.

Chemicals and salt erode paving. Cinders require a clean-up job at the first thaw. None of these methods will really do an efficient job; there's still the danger of someone slipping on an icy patch. What's more, your business can be delayed due to snow-covered drives and loading-dock areas.



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"Open for Discussion"

Continued

ature from dropping a few degrees, the conditions were entirely satisfactory, and we realized a temperature drop could have been prevented by increasing the air flow if we had considered it worthwhile.

Due to the arrangement of the depressed ramp, outside wind velocity had practically no effect. As the air left the fans it was directed so as to impinge upon the outside walls at an angle of 30 degrees to the direction of vehicle travel, if no negative pressure existed in the interior of the building.

With a slight negative pressure the air stream would "bend back" depending upon the pressure. Part of the air would spill back into the interior, and swirl around to rejoin the jet air stream, while the remainder would find its way back into the fan inlet, or join the general air in the interior.

Fundamentally, this system is simply an exhaust with certain directed characteristics, which exhaust takes the place of a previously used exhaust fan in the general area, and consequently negative pressure is not present except in very rare instances.

C. F. Mowrey
Consultant

Case History: Where Inefficiency Reigns In Wood Processing Plant

The article, *Economy, Conservation Keynote Process Piping, Heating System* by William F. Smoots in the July issue is one deserving careful reading and study by managers and engineers in charge of operation of wood precessing and other plants.

This well written story points the way to better operations and higher overall plant efficiency. What has been accomplished in the utilization of waste heat fuel at South Boston, Virginia may largely be duplicated in many other wood processing plants throughout the country if management can be made to comprehend the economic advantages of proper wood burning for boilers.

During the past eight years, this writer has analyzed the operating procedures of several wood processing plants located below the Mason-Dixon Line. Of these, several were equipped with modern waste wood burning equipment and doing a fine job of producing steam at the pressures and in the quantities desired.

However, all the operations inspected did not show up so well. One of the plants — the worst of those that failed to do a good job — had been subjected to extensive complaint by property owners because of smoke damage.

The following is a brief outline of the plant in question and its operation. The boiler consisted of one unit, water tube with a total of 2126 sq ft of tube surface. Refuse fuel was burned in a Dutch oven having a volume of 273 cu ft above the grates.

Fuel was dumped into the Dutch oven furnace through an opening in the top. An obsolete type conveyor carried the fuel from the storage structure to the furnace, and dumped it in a cone shaped pile on the grates.

Conveyor operation was intermittent and manually started and stopped as steam demand varied. At times the boiler was overloaded by the demands of the dry kilns. This intensified the smoke problem.

Much of the fuel delivered to the Dutch oven was pulled into the boiler furnace through the opening that connected the oven with the furnace area below the boiler.

The draft produced by the 150 ft high stack was terrific. The stack itself was intended to serve a second boiler at some later date, but no means had been provided for draft control.

The moisture content of the fuel as fired was quite low, but some of the fuel was pulled into the stack breeching because of the exessive draft. Here considerable after-burning occured resulting in high stack temperatures (900 to 1200 F).

Intermittent operation of the fuel conveyor, the build-up of large piles of fuel on one area of the grates, and the absence of means for even fuel spreading were the principal causes of excessive smoking. With these conditions, large quantities of unburned carbon were being driven off to pass out the stack without igniting.

To correct the conditions causing the smoke, and at the same time to improve boiler plant efficiency, it was recommended that the volume of the Dutch oven be increased to the extent of the space available, and that a spreader type conveyor be installed to replace the old one.

As is often the case, only a portion of the cure was carried out by the owners. Matters have been improved considerably, but sadly enough in the final analysis only a half-sole and heel job was done.

C. T. Baker
Consulting Engineer

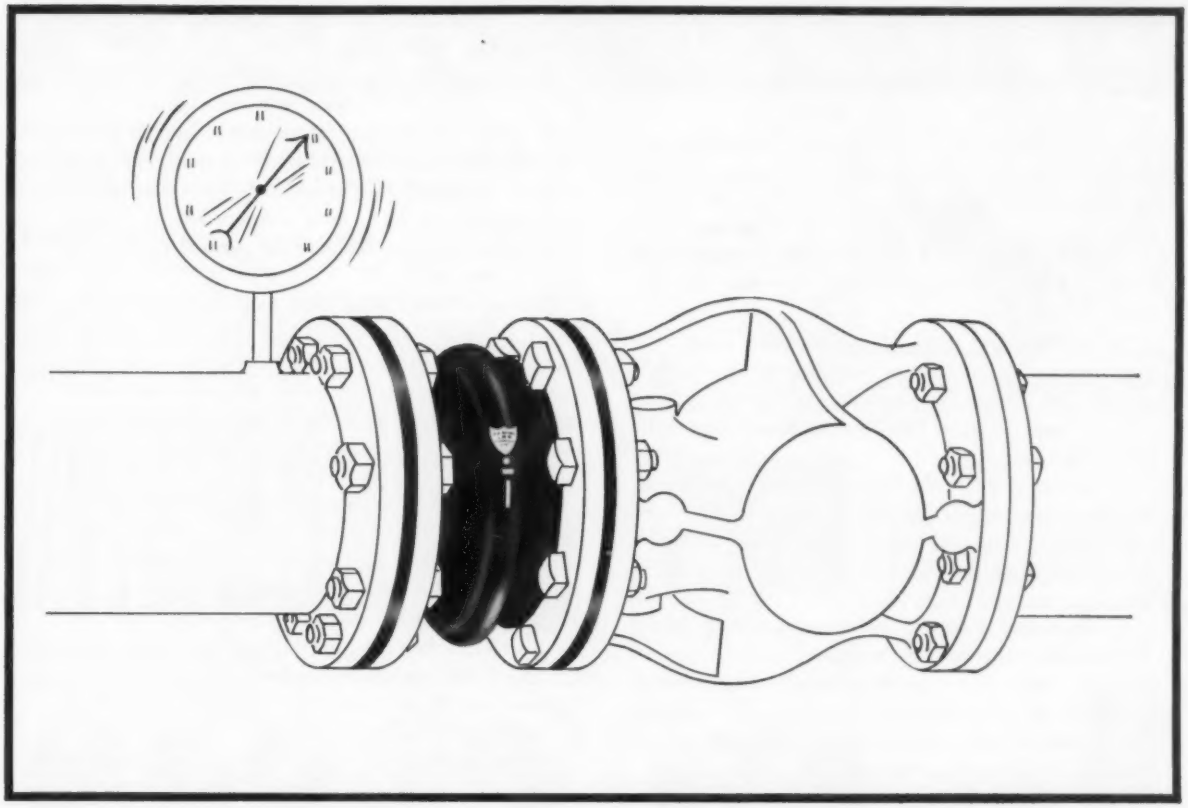
What About Makeup Air, Evaporative Cooling for Steam Pressing Plant?

I would like to offer the following comments on the article, *Integral Exhaust Hoods "Cool" Steam Pressing Job*, by Alfred C. Jutzi in the May issue. Mr. Jutzi's article brings forth two questions, and prompts me to recount our own experiences.

I can understand how hoods on the press heads can capture the biggest percentage of steam, but I

Continued on page 84

US RUBBER EXPANSION JOINTS



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Today's power and processing systems require piping that withstands flow surges, high pressures, and high temperatures unheard of a few years ago. Going hand in hand with improved piping is the simultaneous demand for better expansion joints.

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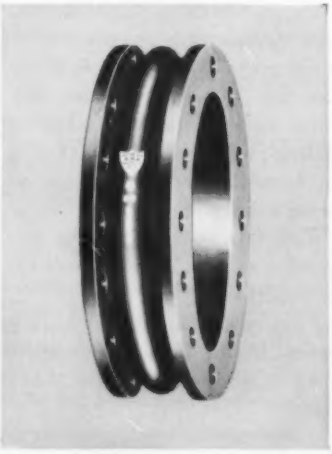

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"Open for Discussion"

Continued

cannot see how there could be any reduction of radiant heat unless from one of two causes:

1) A reduction in temperature of the surface of the press due to the movement of air across it — seemingly undesirable since a warm press face is an essential part of the operation of the machine.

2) The psychological effect on the operator just knowing that something is being done for him (or her).

No mention was made of makeup air. There was reference to "industrial type operating window sash," so one must assume the windows were opened to provide makeup air. I see two obvious disadvantages, if this is the case:

1) Entering air could be very dirty, especially if the plant were in a large city and particularly if in an industrial neighborhood. I would think dirt would be the last thing the client would want on the clothing.

2) In cooler weather, draftiness would be likely for those operators near the windows.

In our business, we operate a laundry and pressing operation for our uniforms. As you might suppose, this is one of our warmest areas in the summer — and even in late spring and early fall.

After much discussion and cost estimating, we decided upon an evaporative cooling system. However, we did not attempt to cool the entire area, but instead placed outlets at each operator's station. These outlets have dampers which can be adjusted by the operator to get as much or as little air flow as is desired.

The system is perhaps assisted by the fact that each operator runs two presses — while one is in the pressing cycle, the other is being loaded. Not only does this increase production, but it affords the operator an opportunity to move around. In addition, while a press is closed and causing steam to be emitted from the garment, the operator is of necessity facing a different direction.

With this system, we have greatly contributed to operator comfort, and have not aggravated a makeup air situation.

I am now wondering if inclusion of hoods as described by Mr. Jutzi in our system would not result in a combined system, better than either one by itself.

G. B. Walden, Jr.
Department Head
Mechanical Engineering
Eli Lilly and Co.

The Author's Reply — In answer to the questions raised by Mr. Walden; The first question was about the effectiveness of the reduction of radiant heat. The conductivity of aluminum is about four times greater than that of the cast iron press head, which reduces surface temperature and thus radiation. Emissivity of aluminum is about six times less than that of cast iron, which further reduces radiation. This, plus the air movement between hood and press head results in a hood surface temperature quite close to room ambient. During the design of this system there was concern expressed on the part of the owner about the reduction in press head temperature as related to the pressing operation, and the possible increase in steam consumption.

Experiments had been previously conducted by the owner in insulating the head of the press with approximately ½ in. of glass fiber insulation with some degree of success. Consideration was given to insulating all press heads in a similar manner prior to the installation of the exhaust hoods, but this was not done.

Experience has indicated during the past year of operation, that whatever reduction of press head temperature has been affected, this had no noticeable effect in the efficiency of the pressing operation.

There is no doubt that the psychological effect of the visible results in the operation of this system contributes to the operator's comfort; however, it is my opinion that the material results accomplished are of far more significance.

The second question was on the source of makeup air.

This building is located in a residential area and natural ventilation through the operating sash has always been the primary source of ventilation. The B. Kuppenheimer Company maintains a rigid inspection of their finished garments and natural ventilation has never presented a problem. There are, however, makeup air units located throughout the plant, two of which are located adjacent to the pressing department, which are used in cooler weather for this purpose. I am sorry this was not mentioned in the article.

The evaporative cooling system installed for Eli Lilly and Co. is apparently the type of system that was originally contemplated for the Kuppenheimer plant, which provides spot cooling for the operators. A combination of this type of evaporative spot cooling and the press hoood exhaust system installed at Kuppenheimer should unquestionably provide the maximum efficiency and human comfort for this application. The opinion at this time, however, is that there is no need for additional conditioning at Kuppenheimer.

The B. Kuppenheimer Co. is quite satisfied with their installation and offers an invitation to anyone interested in making an inspection.

A. C. Jutzi
Skidmore, Owings and Merrill
Architects and Engineers

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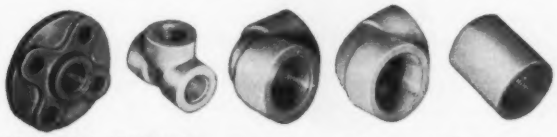

VAN-COR FITTINGS—Sizes from ¼″ thru 12″. Includes: threaded fittings, socket fittings, flanged fittings, belled fittings and special fittings.

VAN-COR VALVES

Sizes from ½″ thru 3″. Types include diaphragm valves, plug valves, lift check valves, ball check valves, ball valves, and Walworth "Y" globe valves.

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Thicknesses range from 1/32″ thru 2″. Sheet stock size is 48″ x 96″. Transparent on special order.

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Sizes: 1½″ x 1½″ x 3/16″ and 2″ x 2″ x ¼″. 10 ft. lengths.

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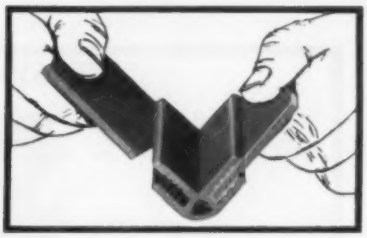

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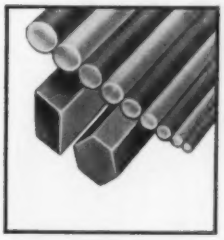

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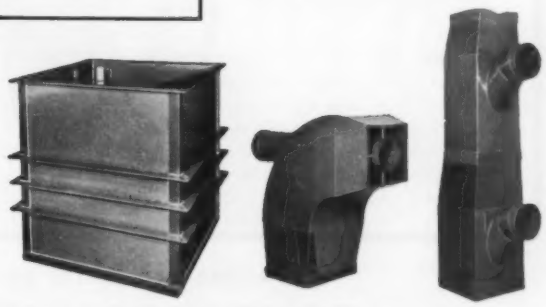

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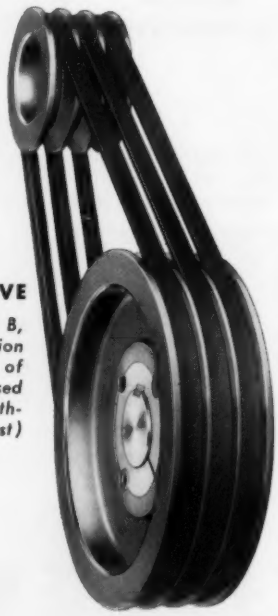
DODGE Dyna V



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	BELTS		SHEAVES			CENTER DISTANCE	HP	WEIGHT (LBS.)	COST	
	Number	Size	O.D. Driver	O.D. Driven	Width				Per hp	Per Drive
BIG-GROOVE TAPER-LOCK DRIVE	3	A42	4.15"	8.95"	2½"	12.3"	4.62	24.7	$5.55	$25.73
DYNA-V TAPER-LOCK DRIVE	2	3V400	3.35"	8.00"	1$^{3}/_{32}$"	10.8"	5.0	18.0	$4.50	$22.41
% SAVING *Savings vary with different sized drives*			**19%**	**10%**	**56%**	**12%**	+	**27%**	**18.9%**	**12.5%**

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question of the month

"How Can We Get Smooth Operation When Heating with High Pressure Process Steam?"

This question was asked previously in Heating, Piping & Air Conditioning, and is repeated here, along with two answers that have been received. Other solutions or comments for publication are invited.

"In designing a heating system to operate in conjunction with high pressure process steam, certain questions have arisen in our office.

"The boiler is to operate at 150 psig, and condensate is to be returned through a vented receiver and pumped back to the boiler. None of the steam should be contaminated.

"In designing the heating system for the building, which will include 11 unit heaters averaging 300,000 Btu per hr output, questions concerning the selection of the traps and the disposition of the flash steam likely to be encountered need clarification. We are not sure about the trap selection — whether to use a bucket trap or a float and thermostatic trap.

"Would the intermittent discharge of a bucket trap cause more flash steam to form with resultant noises in the return line?

"Would any flash steam brought back to the vented receiver be of such a quantity as to be objectionable?

"Since the ceiling height is great and there is no danger of anyone burning himself on the return main, we have considered the possibility of leaving off the return main insulation to insure condensation of any flash steam by the time it gets all the way back to the receiver.

"The equivalent length to the most distant unit heater is approximately 500 ft. Pipe sizes are based on a pressure drop of 5 psi in the supply main. Should any precaution be taken for noise due to excessive steam velocity?

"We want to be sure that any banging in the return line due to the flash steam is prevented. The return piping has been sized for a pressure drop of 0.5 psi. We have considered the possibility of installing a 3 ft section of fin pipe after every trap at each unit heater to assist in condensing any flash gas. Do others think this is necessary? Are there any precautions which should be observed in particular?"—L.L.L.

Knowing What Really Causes Noise Will Help Designer Avoid Problems

Reader L.L.L. is, naturally, concerned about the possibility of noise in the condensate return line of the high pressure heating systems, because not only is this objectionable, but it can be dangerous and damaging to the equipment in the system. It might, therefore, be useful to consider the reason for noise in such systems, as this should automatically provide the answer to the question of steam trap selection.

Contrary to the commonly-held belief, noise in a condensate return system is not generally caused by the *expansion* of flash steam as pressure on the condensate is reduced, but by the *contraction* of the flash as the steam bubbles collapse. This is the reason that noise in condensate return systems is more common when the high pressure condensate is discharged into a condensate return line carrying condensate at a fairly low temperature; for example, high pressure traps discharging into a pumped condensate return system.

When condensate from high pressure equipment is discharged at a steady rate into a simple condensate line, the steam bubbles are, in fact, carried along with the condensate at boiling point; the temperature being dependent upon the pressure at that particular part of the system, which pressure is gradually falling the further the condensate travels.

When condensate from a high pressure system is discharged into a main carrying low temperature condensate, however, the steam bubbles, which have a large heat transfer area but, individually, a small heat content, can rapidly give up their heat. The bubbles collapse violently, causing what may be referred to as reverse water hammer.

For a given rate of condensation in the equipment, the weight and volume of flash steam generated per hour is the same regardless of whether a blast discharge or a continuous discharge trap is used. However, the *rate* of discharge on the bucket trap during the time it is discharging is usually considerably greater than that of the continuous discharge float trap.

Continued on page 88

question of the month

Continued

However, it should not be concluded from this that under all circumstances all bucket traps discharging high pressure condensate into a cold condensate line will create noisy conditions. The difference between the continuous discharge float trap and a bucket trap is that while both may have the same safety or load factor, which is the ratio between the amount of condensate they are expected to handle and the maximum discharge capacity of the trap, the float trap will automatically regulate itself to give continuous discharge of condensate at the rate at which it is being formed; whereas the inverted bucket trap opens intermittently and during the time it is open discha-ges at its full rated capacity, which may be several times the rate of condensation in the system.

It is readily understandable, then, that if the bucket trap is chosen with a high safety factor, objectionable noise may be created because of the rate at which the trap discharges and, therefore, the rate at which the steam bubbles can condense.

Taking an overall view of the proposed heating systems, it is true that the lower the steam pressure at which the heaters can be supplied, the greater the thermal efficiency is likely to be, because of the higher latent heat of low pressure steam and the considerably smaller amount of flash steam that is lost. This saving in operating cost, however, has to be balanced against the increased capital cost of the larger steam mains and larger unit heaters that are required on low pressure steam.

For this reason, flash steam should not always be considered as an evil. In the particular case in question, for example, if nine of the unit heaters were fed with steam at 150 psi discharging condensate into an adequately-sized condensate line leading to a flash vessel in which flash steam could separate, the flash steam could be fed at, say, 5 psi to two more low pressure heaters in order to get the aggregate heat input required. Condensate from the flash vessel could then be discharged at very little above 212 F and the two low pressure heaters could similiarly discharge low pressure condensate, generating a negligible amount of flash, which would probably be condensed in the return lines.

While a system of this kind is largely self-balancing, a reducing valve, supplying make-up steam to the two low pressure unit heaters, could be set to maintain a constant 5 psi by making up steam as required. Such systems are by no means uncommon, and combine the advantages of the small steam mains and unit heaters on high pressure, with the thermal efficiency of low pressure steam heating.

While with such a system it is not likely that noise would present a problem, continuous discharge float traps would be recommended in order to insure constant flash steam supply to low pressure sections.

A. MILNES
Director of Engineering
Sarco Company, Inc.

Intermittent or Continuous Operation Is Important Factor; Other Comments

REGARDING the question of possible difficulties which might be encountered when using high pressure process steam for heating purposes, L.L.L. does not state whether or not the heating system will be operating continuously. Intermittent operation due to holidays, shifts, etc., means frequent start-ups.

Maximum condensation load occurs during warm up of a cold system. Usually a factor is applied to compensate for this condition. For mains and risers, 200 percent of normal condensing rate is a suggested minimum, with 300 percent applied to unit heaters.

The following formula may be used for estimating condensation rate during warm up of a piping system:

$$Q_w = W(t_f - t_i)0.114 \times 60/h \times T$$

where

Q_w = condensation rate resulting from warm up, lb per hr
W = total weight of pipe, fittings and valves, lb
t_f = final pipe temperature (steam), F
t_i = initial pipe temperature (air), F
0.114 = specific heat of steel and wrought iron, Btu per lb per F
h = latent heat of steam at t_f, Btu per lb
T = warm up period, minutes

These relations indicate that long warm up periods allow reduced condensation rates, permitting use of smaller traps and accessories.

Allowance for radiation losses during warm up should also be included when sizing traps. The value increases as warm up rate decreases, with maximum occurring at about half-way of the warm up period. Adding one-half of the radiation load to the warm up value, gives total condensate quantity to be handled by the traps. Condensation rate due to radiation may be calculated from the formula:

$$Q_r = U \times L(t_f - t_i)/h$$

where

Q_r = condensation rate due to radiation, lb per hr
U = overall coefficient of heat transfer, Btu per hr per sq ft per F
L = total equivalent length of pipe system, ft

L.L.L. mentions boiler steam pressure is 150 psig but does not state if reduced pressure will be used for the heaters. For high pressure services, a bucket trap with an air bypass should be used, whereas a float

Continued on page 90

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TABLE 1 — TRAP TYPE COMPARISON of units commonly used in services similar to heating with high pressure process steam. Selection will depend upon whether or not process steam pressure will be reduced for use in comfort heating

Trap type	Pressure range	Characteristics
Thermostatic	Vacuum to 300 psig	High capacity, intermittent discharge. Will discharge air and take water hammer. May be used with superheated steam but not varying pressure. Limited condensate temperature range.
Float	Vacuum to 200 psig	Nearly continuous discharge. Will not discharge air, nor take water hammer. May be used with superheated steam and varying pressure. Subject to leakage due to unequal expansion of valve and seat.
Float and Thermostatic	Vacuum to 40 psig (Some to 200 psig)	Less subject to leakage resulting from unequal expansion.
Upright bucket	Vacuum to 1200 psig	Intermittent discharge. Will not discharge air; will take water hammer. May be used with superheated steam and varying pressure. Will take pulsating pressure.
Inverted bucket	Vacuum to 2400 psig	Intermittent discharge. Will discharge air. Suitable for large quantities of foreign matter (dirt, sludge, oil). Will take water hammer. May be used with superheated steam and varying pressure.
Lifting	Vacuum to 150 psig	Similar to upright bucket type.
Flash	Vacuum to 450 psig	Intermittent discharge. Good for high pressures and temperatures. No moving parts. Has adjustable orifice for varying pressure drop.
Impulse	01 to 600 psig	Intermittent discharge at normal load, continuous discharge at high load. Will take water hammer. Design is variation of flash trap, operating in a similar manner.

trap may be employed for lower pressures. Table 1 lists a brief comparison of traps frequently employed for these services.

Design pressure drop for steam supply piping is influenced by initial steam pressure. A high pressure system having more dense steam can tolerate a greater loss than that for a low pressure installation. The permits use of smaller diameter pipe at conservative velocities.

A value not greater than approximately one-third of the initial pressure may be used as a guide. Table 2 lists unit and total pressure drops frequently employed for these services. The respective pressure drops of 5 psi and 0.5 psi for steam and condensate as proposed by L.L.L., are very conservative and should not present hammer and/or noise problems.

L.L.L. is considering use of finned pipe after the traps to aid condensing. This is not necessary. However, a length of pipe not less than 2 ft should be installed before themostatic traps. This allows cooling the condensate in the pipe rather than in the heating element. The latter reduces heat transfer effectiveness.

Receiver size should allow for makeup water required during startup, thermal expansion of water during operation, and flashing and venting of vapor and noncondensible gases. Knowing condensate pressure and temperature, L.L.L. can estimate flash quantities.

For satisfactory operation, receiver and vent diameters need be large enough to provide adequate disengaging surface for vapor-liquid separation and removal of resulting vapors and gases.

Elimination of insulation from the condensate return piping, will aid cooling to some extent. This will limit flashing in the receiver, reducing evaporation losses and resulting required makeup.

H. B. WAYNE
Consulting Engineer

TABLE 2 — ALLOWABLE PRESSURE DROP guide related to value of initial pressure in system. Higher pressure systems, having more dense steam, can tolerate greater losses than can initially low pressure systems. Total drop should not exceed one-third of initial steam pressure to avoid hammer and/or noise problems

Initial pressure, psig	Pressure drop per 100 ft, psig	Total pressure drop, psig	Percent of initial pressure
2	0.125	0.50	25
5	0.25	1.50	30
10	0.50	3	30
15	1	4	25
30	2	5 to 10	15 to 30
50	2 to 5	10 to 15	20 to 30
100	2 to 5	15 to 25	15 to 25
150	2 to 10	25 to 30	15 to 20

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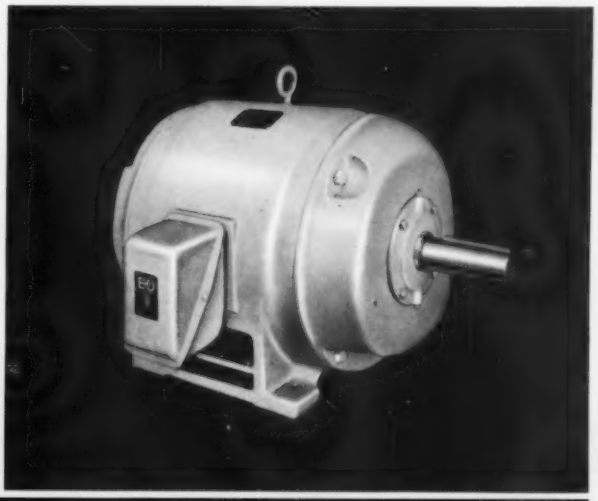

Motor Frame Size	NEMA Standard Balance*	Electro Dynamic (1) Standard Balance*
182 – 256U	.0010 inches	.0005 inches
284U – 326U	.0015 inches	.00075 inches
364U – 405U	.0020 inches	.0010 inches
444U – 507W	.0020 inches	.0010 inches
580 and Larger	Contact Bayonne	

*Balance Figures are Peak to Peak measured as specified by NEMA

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Upper-Lower, Inside-Outside Many-Zone Design Air Conditions Bank Building

THE FIRST new skyscraper to be built in Minneapolis in the last 25 years —the First National Bank Building — is air conditioned by a combination of perimeter induction and high pressure interior systems of a size to match its skyline prominence.

The building consists of a 5-story, 230 thousand sq ft base topped by a 23-story tower containing 180 thousand sq ft of rental space.

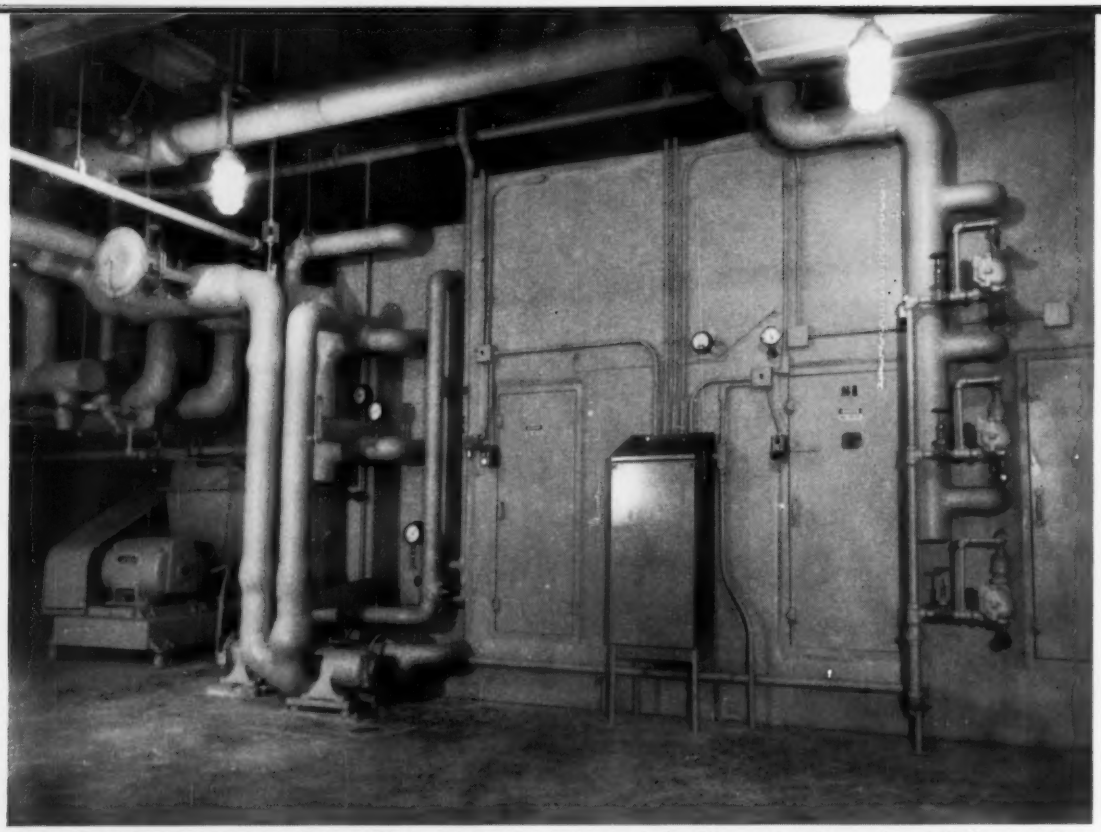
Mechanical equipment for the air conditioning systems occupies two entire floors; the sixth and the 27th, plus additional space in the sub-basement.

Statistics Indicate Complexity

Some interesting statistics on the mechanical installation — two centrifugal compressors provide 1800 tons refrigeration capacity — two of three 500 ft deep wells deliver a peak load of 2000 gpm of 54 F water for condensing purposes — there are 11 centrifugal fans and 21 multi-zone units for supply air, and 23 centrifugal exhaust fans — 860 thousand cfm of air is supplied through 13 miles of low pressure ducts and 5 miles of high pressure conduit plus two miles of flexible duct — sheet metal work consumed 500 tons of material — there are 2190 induction units and 3400 diffusers, registers, and grilles — both interior and perimeter systems use air at high velocity (3500 fpm) and high pressure (9 in. WG) to contend with interior loads plus heat loss and gain through nearly two acres of fixed glass windows.

Serve Upper and Lower Sections

The sixth floor mechanical equipment conditions air for the 5-story building base. Tower spaces are served by the 27th floor installation. Primary chilled



SIXTH FLOOR equipment installation includes 35,500 cfm built-up air handling unit, above, plus chilled water lines, below, for perimeter induction equipment and high pressure interior system. The 27th floor is also given over to mechanical equipment, which supplies air conditioning for the building's tower. Chillers are located in the sub-basement

water is circulated from the refrigerating machines in the sub-basement to cooling coils for the interior and perimeter systems on the two upper floors through 10 in. and 8 in. risers. Pumping capacities for the bank and tower sections of the building are 1800 and 1500 gpm, respectively. Hot or chilled secondary water (50 to 180 F) is supplied by three secondary systems to the perimeter units. Secondary water pumps are located in the basement and on the sixth floor.

Vary Water Circulation Plan

Primary and secondary water systems are linked for summer operation. Primary water returning from the cooling coils on the bank and upper tower floors passes through a three-way valve, warming the secondary water sufficiently to prevent condensation. Secondary water for the lower tower (seventh through 16th floors) does not mix with the high pressure system. Instead, chilled water from the primary system passes through a heat exchanger on its way to the cooling coil.

Tower Interior System

Each floor in the tower is divided into four interior zones. A single air handling system serves given zones on a number of floors. In winter, outside and recirculated air is warmed to about 45 F in a preheat coil, then passes through an electronic air cleaner and is raised to about 65 F through a reheat coil. Air flow is slowed by pressure reducing valves, and sound reducing chambers are installed in the ducts prior to the ceiling diffusers. Air can be heated to a temperature of 85 F by a steam booster coil, controlled by the zone thermostat.

In summer, preheat and reheat coils are idle, with air passing through the cooling coil, cleaner, and steam booster coil for reheating if necessary.

Temperature extremes are created by the vast glass area of the tower, where the window-to-floor ratio is 1:2. High velocity air is therefore delivered through induction units beneath each window, after passing first through a preheat coil, cooling coil and reheat unit.

Return air to the induction units passes over the secondary water fin tube bundle, containing either chilled or warm water.

The perimeter system is designed to moderate space temperatures at distances up to 15 ft from the windows, with a possible 25 F temperature differential between the interior and exterior zones. Induction units are paired for control purposes, with a single thermostat controlling two units.

Bank Floors Systems

The lower five, or "banking" floors of the building are divided into 32 zones, served by a similar interior system.

Perimeter induction units are also used on these levels, but differ from the tower design in that air flow is directed out into the room rather than as a vertical blanket effect. This is because the large windows on these levels extend to floor level, and the induction units are installed beneath the floors with a return air grille between unit and window. The result is that cold or warm air is taken off the window down into the induction unit, instead of directly into the room.

One column-mounted thermostat regulates the secondary water flow through each four induction units for heating or cooling.

Purchase Steam for Heating

Although space has been provided for the eventual installation of boilers, the First National Bank Building currently buys steam from the adjacent Soo Line

INDUCTION UNITS around perimeter of five lower (bank) floors direct air out into room instead of up along windows. Ducts, coils, and valves are installed below floor level

Building, at a peak demand of some 25,000 lb per hr. Steam is delivered via a 6-½ in. main through a three-station pressure reducing system which drops pressure from 150 to 25 psi for cafeteria use and to 10 psi for heating and air conditioning. The lower pressure steam is also used to heat water to 180 F for use in cleaning elements in the electronic air cleaners, and to heat oil for a snow removal system installed beneath ramps, sidewalks, and plaza areas.

Nearly 25 miles of steam and water piping is used to supply the 2000-plus induction units and 167 additional pre-re-and-booster heaters. In this system there are some 1200 thermostats and about 2000 automatic valves.

Central Panel Controls All

Year 'round air conditioning equipment is controlled by means of a complete central panel located in the sub-basement. This panel provides for checking and recording of key temperatures from the interior and perimeter systems, relative humidity readings and control, operation of pneumatic motors and valves, control of water pressures and flow in heating, cooling, and ventilation operations, and on-off control of all fans for the building's 52 separate air handling systems.

On winter nights, the secondary water temperature is raised to 180 F to keep the building comfortable for night-hour use. Perimeter fans are automatically energized should the temperature drop too low.

Steam supply to the secondary system converters is secured when outside temperature rises to 45 F, at which time pneumatic by-pass valves shut off the secondary flow through the converters. The three-way valve on the secondary system mixes primary water at 42 F with secondary return water to hold the temperature at 50 F. Steam is then directed to the reheat valves on the perimeter system and to the booster coils on the tower interior system.

Pneumatic pressure to the 1200 thermostats in the building can be cut from 17 to 13 psi, changing them from direct to reverse action. The thermostats then act to open the valves to the induction units when additional cooling is needed for perimeter areas.

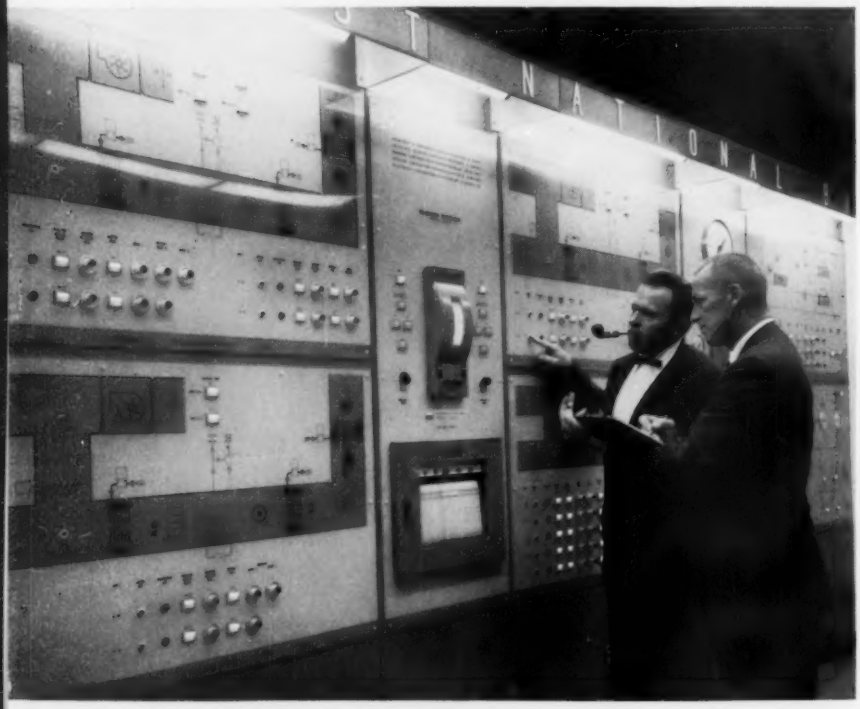
In winter, when more heat is required at the building periphery, the pneumatic system operates at 17 psi and induction unit valves are then opened by direct thermostatic action.

Lower Levels Also Conditioned

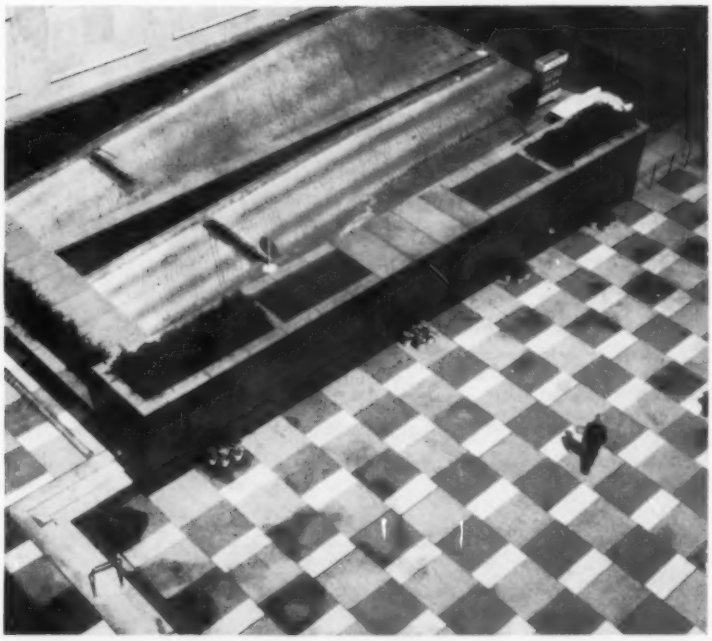
Basement and sub-basement areas, including the bank vault, vault record space, and bank storage space are also air conditioned, with air intake and exhaust openings for these levels located on the sixth (equipment) floor.

Windows in the first floor lobby are kept frost-free in winter by means of heating units installed along the wall base. Vestibules to the lobby have supply ducts at the tops of the revolving doors and convectors installed in the passage sides for additional heat.

A two-level, 80-car garage is included beneath the bank plaza for drive-in banking. Mechanically fil-



CONTROL PANEL in basement allows regulation of all air conditioning functions throughout building, plus recording of key readings on regular schedule



RAMPS to and from building plaza and basement garage include provision for supply and exhaust air access, through large grilles in center of photo

INSIDE basement garage, concrete block exhaust air intakes are located so as to be within 30 ft of tailpipe of any parked car

tered air is delivered to the garage at the rate of 27,000 cfm, and contaminated air is removed by a separate two-fan ventilating system. Exhaust air intakes are so placed that there will be one within 35 ft of the tail-pipe of any parked car. In winter, the garage receives warm air from the bank level. Grilles in the plaza above the parking facility provide supply and exhaust air access, via sub-basement fans.

Ramps leading to the garage are fitted with folding doors to maintain a reasonably constant temperature despite traffic.

To accomplish the mechanical installation, two firms joined forces. Bjorkman Brothers Co., and Commercial Air Conditioning, Inc., both of Minneapolis, joined under the name B/C Co. to install the heating, piping, and air conditioning systems. Consulting engineers and architects for the building were Holabird & Root, assisted by the firm of Thorshev & Cerny. ≠

The editors wish to acknowledge the cooperation of Messrs. W. T. Gove, Assistant Market Manager, Minneapolis-Honeywell Regulator Co., and Chester A. Gile in the preparation of information for this article.

• Contrary to some opinion, water, fuel, or purchased steam losses in the relatively small boiler facility are just as important — and just as susceptible to correction — as they are in large plants. In fact, a higher savings-to-investment ratio may be realized on 2000 to 100,000 lb of steam per hr plants than could be obtained in much larger installations.

Here are some things which should be done to assure a maximum return for the mechanical dollar — with the proof of the pudding from the author's personal experiences.

By GEORGE R. CHADWICK
Consulting Engineer

Increase your boiler plant efficiency —

A Check on Small Losses Can Yield Big Savings

THERE ARE a great many ways to save fuel, water, and power in the small plant. We will discuss a few conservation principles here, and illustrate them with examples drawn from personal experience.

Areas for Saving

Water and fuel (or purchased steam), are two items of expense over which management has some control. It is a question first of simple economics — of determining the dollar value of the utility being wasted, the amount that can be saved, and how much it will cost to make the saving. It may be that the cost of making the saving will be too great to justify (considering the rate of return on the money invested) or it may happen that further study will reveal a less expensive way of doing a job so that it becomes a worthwhile investment.

First Investment Is Time

I was consulted by the owner of a small plant, used largely for heating but also for some process work, where considerable lengths of steam pipe were left bare in places where heat was not needed. Obviously, insulating these pipes would have saved fuel, and in fact the operating engineer had so recommended on several occasions. He had never, however, taken the time to calculate how much heat was being wasted, what fuel saving could be realized, or what it would cost to do the job.

All of these figures, except the last, are readily available to the operator, and the cost estimate can be obtained from any supply house. When the figures were presented to the owner, and he saw what could be saved, the job was done.

It is probably possible to save utilities in any existing plant. Particularly in small plants, the savings possibilities are likely to be very high in relation to the investment required.

Saves Cost of New Boiler

In Des Moines, Ia., the single HRT gas-fired boiler of a dairy processing plant seemingly could not carry the load, and the plant engineer had recommended the installation of more boiler capacity.

After we made combustion tests and a plant survey of requirements and losses, a number of minor changes were made. The boiler setting was sealed, the fuel-air ratio adjusted, pipe insulation was added, and a minor change in the boiler combustion cham-

ber effected. The original boiler has in fact carried the load for eight years.

Fuel Saving Fallacies

One common fallacy is that smoke in itself represents an appreciable fuel waste. Unburned fuel does have heat content, probably about 14,000 Btu per lb, but a small amount creates a dense smoke. In fact, the percent-loss in smoke is so small that it is never considered in computing a heat balance.

More fuel is wasted from stacks that are clear as the mountain air than from belching stacks. Most boiler plants are wasting fuel from excess air. (The smoking boiler can of course also be suffering from excess air.)

This doesn't mean we should ignore smoking stacks. If there is smoke leaving a stack, soot is being deposited on boiler heating surfaces which will cause fuel waste. But even this is generally over-rated.

We are subjected at times to claims that the removal of 1/16 in. of soot will increase efficiency 15 or 20 percent. The latter, if you began with a boiler efficiency of 60 percent, would mean a fuel saving of 25 percent.

Laboratory tests comparing a clean metal plate with one covered with various thicknesses of soot can be misleading for two reasons: 1) a large part of the heat released in a boiler is transferred by radiation, and 2) the tests are usually made with the same temperature difference on both sides of the plate. But as soon as a boiler tube is sooted, the temperature difference between the gases and the water is increased, and since heat transfer varies with this difference, the assumption is false.

I have tested many boilers before and after a good cleaning when over 1/16 in. of soot was removed from the tubes, and found that the stack temperature seldom dropped more than 100 F. This represents from 3 to 8 percent savings, depending on the amount of excess air.

Scale Also Over-Emphasized

The same holds true for scale on the water side. Claims that 1/16 in. scale wastes 10 percent of the fuel burned can mislead.

I don't underestimate the importance of a clean boiler. Scale can and often does cause thousands of dollars damage, and soot reduces boiler capacity not only by reducing heat transfer but by increasing boiler draft loss, thus decreasing the supply of combustion air. The latter is, I think, the much bigger factor in capacity reduction.

The point is that when boiler efficiency is low, in very few cases will this fault be corrected *merely* by cleaning. Look elsewhere as well. The most likely demon is excess air. This in fact emphasizes the importance of stopping small losses, one of which is dirty heating surfaces.

Check Your "Mileage"

1) Analyze steam requirements by metering each piece of equipment. Don't depend on "listed" figures; meter the condensate, or for processes, calculate steam needs on the basis of specific heat, weight per hr, and actual temperature rise of the product.

2) Compare steam needs with actual steam generated. If generation value is unknown, a flue gas analysis will give an accurate approximation of boiler efficiency, or meters can be used. Boiler efficiency combined with fuel consumption will yield the amount of steam being generated.

3) The difference between true steam requirements and true steam generated is the goal for savings.

How To Go About It

The first step in a fuel economy program is an analysis of steam requirements for all the various plant services. When possible, each piece of equipment should be checked by metering the condensate. Process equipment requirements may be quite different, and often less, than the listed figures. For many processes, steam demand can be calculated by knowing the specific heat, weight per hr, and temperature rise of the product involved.

After calculating the actual steam requirements, compare this with the actual steam generated, and the difference is a goal for savings.

If the amount of steam generation is unknown and a metering system unavailable, it can be calculated from fuel consumption after determining boiler efficiency.

Accurate boiler efficiency determination also requires meters, but can be closely approximated from flue gas analysis, since the stack loss represents the largest single loss. This analysis will also indicate possibilities of improving boiler efficiency. Fuel suppliers often have combustion testing equipment available for use. Other losses such as unburned fuel and radiation are smaller, and can be figured quite closely. Subtracting the percentages of all losses from 100 yields the boiler efficiency.

Make a Piping Layout

Next, make a layout on paper of the plant piping, and study it to determine ways of eliminating unnecessary lengths — particularly in steam piping which costs money to maintain.

In most process plants piping is being almost continually changed, with some being added and other discontinued. So often, more and larger pipe, with more fittings, is installed than is actually needed. Pipe size need not always be determined by the size opening in the machine — there is no relationship between required size and the opening provided.

Piping location is often determined by the ease of installation, on the basis that a few ft of pipe is relatively inexpensive. But, if fuel oil is 9 cents per gallon, and boiler efficiency 70 percent, 1 ft of 4 in. pipe carrying steam at 100 psig will cost $6.30 in wasted fuel per yr if the pipe is bare and 97 cents if insulated. Even the latter figure is almost as much as the price of standard weight pipe. The loss from low pressure piping approximates 55 percent of these figures.

Layouts Show Inefficiencies

Excess piping elimination was well proved in a 6-story, block-square candy plant where we made a piping layout for each floor. After study, hundreds of ft of piping and 14 pressure reducing stations were removed.

Instead of relying on blueprints, we stretched colored insulated wires where pipes were to be run. Colors indicated what each pipe was to carry, and the wires were labelled for pipe size. Pipes which were to be removed were tagged to reduce mistakes.

Better locations were often revealed when the wiring was done, and obviously, it is much cheaper to move a wire than a pipe. This gimmick is particularly helpful in crowded locations. The wires assist both in making the best possible layout and in guiding the installer.

How Changes Helped

Originally the two 450 hp water tube boilers with a capacity of about 45,000 lb per hr, also served a gum plant where the boilers were located. The candy facility had been sold to our client under an arrangement whereby he would pay 90 percent of the boiler plant cost of operation, this being the estimated relation of the two requirements. The first yr of operation cost him $110 thousand.

Both boilers were being used, although the maximum load was only 22,000 lb of steam per hr. My own CO_2 recorder never went as high as 5 percent, and usually varied between 3 and 4 percent on a 48 hr run.

We removed the dual-purpose plant and installed two boilers of 6600 lb per hr capacity each, right in the candy plant. The first year's operation cost $38 thousand for fuel and labor, and except during the coldest part of the season one boiler carried the load.

Meanwhile, the owners of the gum plant without engineering consultation purchased a used two-pass gas fired boiler rated optimistically at 125 hp. It had only 249 sq ft of heating surface. Trouble was experienced in carrying the load.

When we surveyed the situation, we found that in attempting to make-do, gas input had been set so high that the stack temperature was over 1000 F, with considerable CO present. A number of recommendations were made and followed, most of which involved insulation of piping and equipment. The boiler was then able to do the job.

Locating Leaks

The best time to check for air, water, or steam leakage is at night or when there is no demand on the line. Water meters should be read after plant shut-down and before startup in the morning, and if consumption is appreciable, further checks should be made.

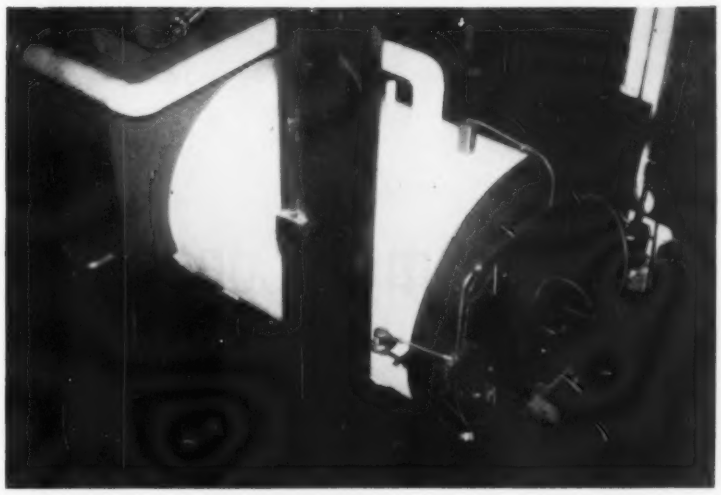
An operations recorder is a handy means of checking unmetered compressed air systems. A 24-hr check on compressor operation will tell if it is running too long. A leak check can then be made and the procedure repeated.

Waste Heat Recovery

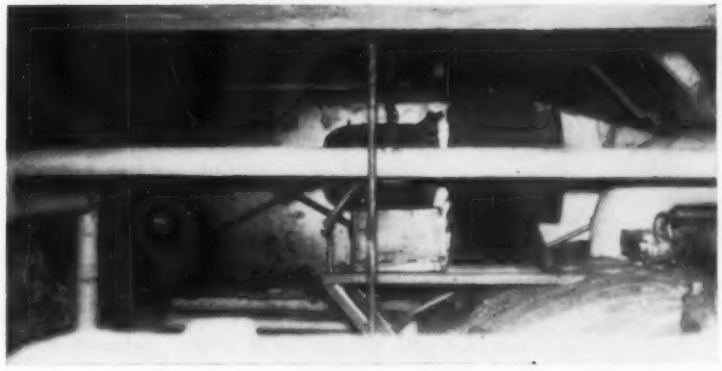
The idea of heat recovery from flue gas by means of preheated combustion air has been applied to small oil and gas-fired plants with gratifying results. Preheated air improves combustion efficiency by reducing the amount of air required as well the temperature of the exit gases.

We converted one of a pair of two-pass firebox low pressure boilers from coal to oil firing and made use of the leftover forced draft stoker fan by remounting it on top of the boiler where the air was about 25 F warmer. A short duct connection was made to the preheater, fashioned from 2 in. structural pipe. An existing barometric draft control was used as a plenum on the discharge side of the breeching. Then we designed a water wall-like extension for the front of the boiler on which the windbox of the burner was mounted. The design is similar to a cyclone furnace, except that it is fire-tube rather than water-tube. This latter alteration aided in the boiler modification to increase efficiency.

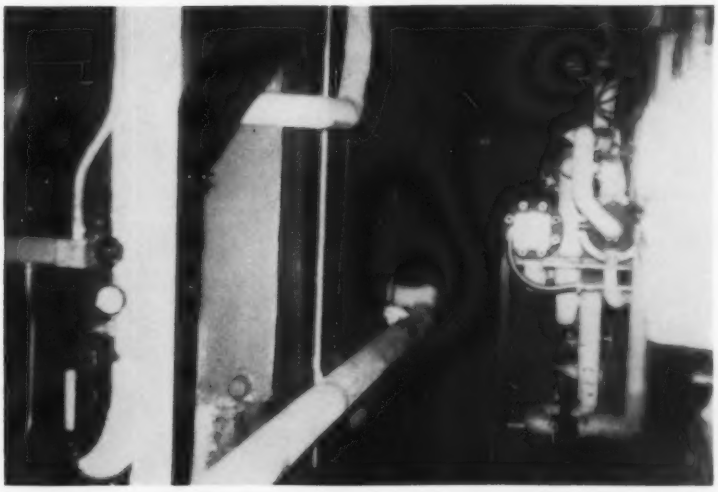
Previous tests on the boiler (when coal fired) showed a stack temperature of over 500 F. The use of the water wall, everything else being equal, would reduce this temperature, but with a much larger load, we assumed that stack temperature would remain about the same. Actually, the stack temperature ranges from 350 to 450 F, and combustion air is at a temperature of about 150 F (we had assumed about 200 F). Even this gain in combustion air temperature is a factor in causing the low stack



CONVERSION of boiler to recover heat from flue gas involved extension of boiler front to house cyclone-like, fire tube arrangement.. Burner windbox is mounted on extension



FORCED DRAFT FAN, left over after conversion from coal to oil, was mounted atop boiler where air was 25 F warmer



SHORT DUCT connection from fan to preheater is seen at left in photo. Stack temperature was decreased, combustion air temperature was raised

temperature, however. We have also been able to operate on 10 percent excess air, which in turn raises the firebox temperature. Fuel consumption comparisons with the companion coal fired boiler at this stage indicate that an efficiency of about 85 percent is being obtained.

Ben Franklin said, "Beware of little expenses; a small leak will sink a great ship." The "little expenses," small losses, can in fact sink the ship, and a thorough job of eliminating their causes is well founded for even the relatively small plant. ⧺

This article is based on a paper presented at the recent American Power Conference.

All-centrifugal system uses outside air and process heat during winter months, generates chilled water for summer cooling

Heat Pumps Condition Year 'Round In Large Factory-Warehouse

By ROBERT G. WERDEN
Consulting Engineer

IN-PLANT conditions of 80 F and 50 percent relative humidity are being maintained in the new 140 thousand sq ft factory-warehouse of the Masland Duraleather Co. in Mocksville, N.C., by an all-centrifugal heat pump system. Previously, heat pumps for large building projects have consisted of a series of reciprocating refrigeration machines or a combination of reciprocating and centrifugal units.

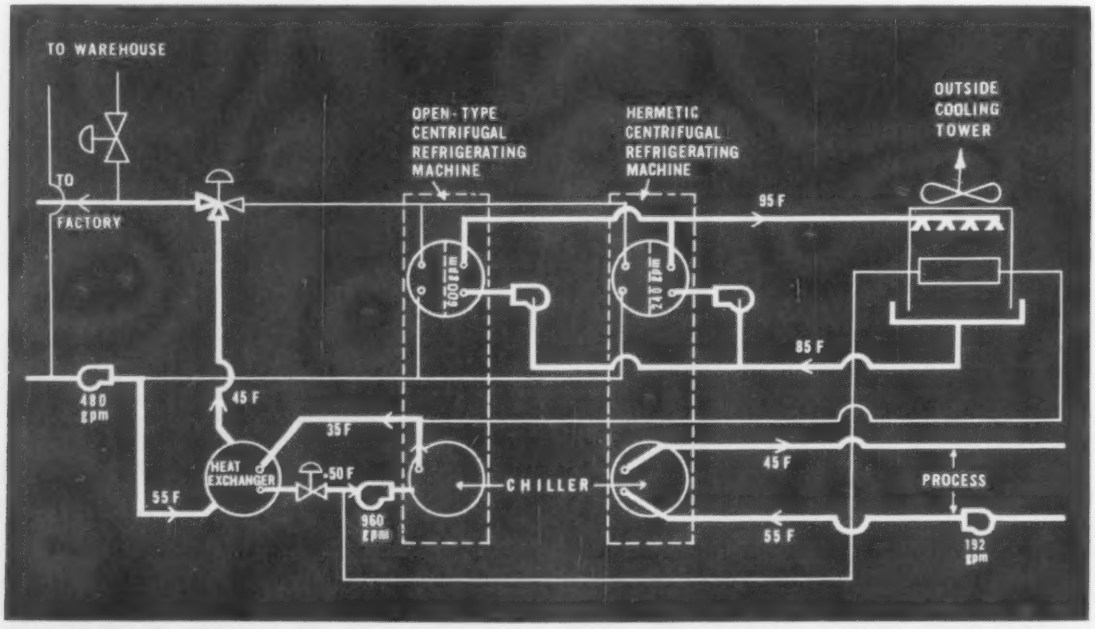
Two Units Do the Job

One centrifugal machine with a capacity of 200 tons of refrigeration is used to cool the major portion of the plant in summer and uses outside air as its primary heat source to supply part of the building's heating.

A second unit of 80 tons cooling capacity provides chilled water year 'round for process work in the plant. During winter months, heat absorbed from this process is used as supplementary comfort heating. A temperature of 72 F with relative humidity at a natural level is to be maintained in colder weather.

Study Shows Economies

Investigation by William F. Lotz, Inc., the engineering and construction firm which designed the



PEAK COOLING operation of all-centrifugal, air source heat pump installation is diagrammed above. Heavy lines indicate flow of water and brine. 200 ton capacity centrifugal chiller is used with heat exchanger to supply chilled water to cooling coils for plant comfort conditioning. Smaller unit provides chilled water for process cooling

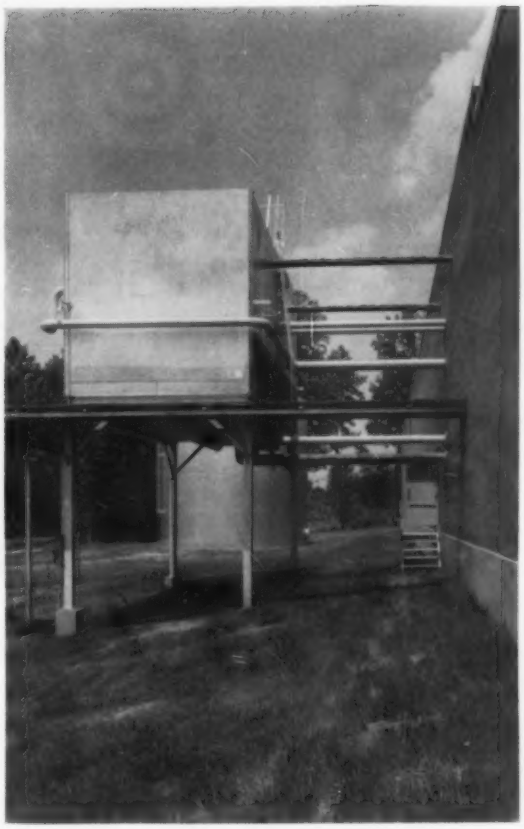
plant, indicated that in the North Carolina weather, and because the masonry wall-brick veneer construction of the plant resulted in an extremely low heat transfer coefficient, substantial savings in operating costs could be effected with the heat pump installation.

Units Are Specially Designed

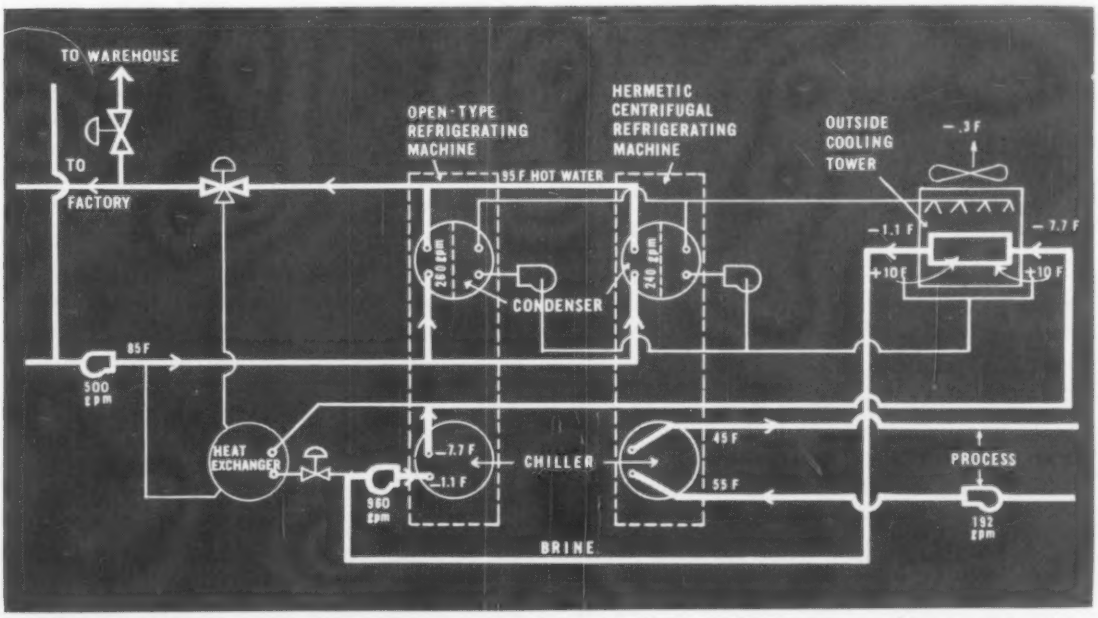
Extraction of heat from the low temperature (10 F) outside air is effected by means of a brine system, using a layer of finned coils six rows deep installed above the condenser water distribution header in each cell of a two-cell cooling tower. The two fans of the tower are used during the winter to pull air through the brine coils. Brine is circulated between these coils and the cooling section of the refrigeration machine, in which it is cooled from −1.1 to −7.7 F. This heat, plus that from the manufacturing process and heat generated by the two compressors, produces 500 gpm of water at 95 F for circulating to the plant air handling equipment.

How Process Supplies Heat

Heat from the plant manufacturing process amounts to 1.2 million Btu per hr, or almost one-half the 2.8 million Btu per hr heating load. The smaller hermetic centrifugal machine supplies 192 gpm of water at 45 F to a vinyl cloth processing machine which adds a strengthening cloth to vinyl



TWO CELL cooling tower, adjacent to refrigeration machines, exhausts heat in summer, extracts heat in winter



PEAK HEATING for winter operation is shown here. Special finned coils in cooling tower are used to extract heat from outside air, which, combined with heat from compressors, provides 500 gpm of water at 95 F for circulating to plant air handling equipment. Process work, described in text, furnishes about half the plant heating requirements. During summer, process heat is exhausted to atmosphere

INSIDE PLANT, six large air handling units, four with heating and cooling coils and two with heating coils only for warehouse section, are installed on platforms suspended from ceiling. One unit is visible in background at left

material used for upholstery, and which prints a design on the material. The design is fused to the cloth strip when the vinyl passes through a series of 10 rollers which are heated to temperatures of from 150 to 300 F. The design is then set by quick-chilling when the vinyl passes through a water spray and over several large rollers containing chilled water.

Provide Tower Coil Defrost

In order to prevent excessive frosting of the cooling tower brine coils, the rows in each cell are defrosted alternately. A pressure sensing device across the coils automatically stops one of the fans and brine flow. 80 F defrost water from a tank in the equipment room is then sprayed over the coils for two minutes, at a rate of 2.7 gpm of defrost water per sq ft of coil surface.

A special grade of trichlorethylene brine which retains its low viscosity and its heat transfer properties at low temperatures is used in the system.

Summer Cooling

For summer operation, the large open-type centrifugal machine cools 960 gpm of brine from 50 to 35 F. The brine is pumped to a heat exchanger which chills 480 gpm of water from 55 to 45 F. Water is then circulated through the air conditioning system.

Process heat from the manufacturing operation is exhausted to the atmosphere during the summer months when comfort cooling is required.

Four Units for Air Handling

Four large air handling units with integral cooling and heating coils are used for air conditioning the main areas of the factory. The warehouse section of the plant is supplied with heating only by two similar units without cooling coils. Several smaller areas, including a "constant temperature" room and office spaces, use individual heating-cooling systems.

Separate Lines to Prevent Fouling

Two separate tube bundles, each of two-pass design are used in the centrifugal machine condensers. Such a design prevents fouling which might occur if water was sent to the plant through tubes used the previous season by cooling tower water.

Each tube bundle always contains the same kind of fluid. In summer, heat from the process load is rejected through one tube bundle to the condenser water which circulates to the cooling tower. In winter, process heat is transferred through the other tube bundle to the water system which circulates warm water to the building's air handling units.

Vary Compressor Speed for Summer, Winter

Refrigerants 11 and 113 are used in the open-type and hermetic machines, respectively. For the larger unit, a single speed motor (1750 rpm) of 300 hp was selected to provide maximum temperature lift in winter when extracting heat from the outside air. In summer, when the temperature differential is not as great, a hydraulic coupling and speed reducing gear allows the compressor to run at a slower speed.

Valley Engineering Co. served as associate to William F. Lotz, Inc., in designing the heat pump system. ∓

Photos courtesy Carrier Corp.

Experiments with simple structure prove

Designers Can Predict Fundamental Vibration Frequencies In Piping Structures

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and

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LCdr. McGarrah is a graduate of the U.S. Naval Academy and received his MSME from the USN Postgraduate School, Monterey Calif., in June of this year. He is an engineering duty specialist, currently stationed at the Charleston, S.C., Naval Shipyard.

Statements contained in this article are the private opinions and assertions of the authors, and should not be construed as reflecting the official views of the Department of Defense.

THE PRACTICAL difficulties of calculating natural vibration frequencies in complicated piping systems have heretofore seemed so overwhelming that an attempt was seldom made in practice. Instead, the general theory of vibrations was applied in a qualitative way, as a guide to design. This at least served to minimize the probability that unacceptable vibrations would occur.

If unacceptable vibrations did occur in an installed system, they were eliminated or reduced by dint of additional constraints, snubbers, and similar devices. However, with the development of high speed computing devices[1], it has become possible to perform the

[1]A partial list of articles published in HPAC on the subject of new and continuing developments in the field of pipe stress analysis by modern methods would include the following:

Brock, J. E., *How Giant Brains Aid Piping Design*, May June & July 1957; *Methods of Making Piping Flexibility Analyses — The Matrix Method*, July 1952.

Parteh, L. E., *Methods of Making Piping Flexibility Analyses*, July 1950; *New Method Speeds Design of Pipeline Expansion Loops and Aids in Checking Existing Loops for Stress*, July 1959.

Hsiao, K. Hao, *Calculating Pipe Stress Efficiently*, September & December 1957, January 1958, and September 1959.

Ellis, H. B., Schmidt, Norma, and Watkins, E. R., *Computer Program KO's Stress Problems in Designing High Temperature Piping Systems*, December 1959.

TEST ARRANGEMENT for "free-free" configuration. Pipe was suspended at two points of zero lateral vibration. Weight suspended from pipe center was released suddenly to excite vibration

exacting and voluminous calculations which are indicated by the theory of vibrations.

Means Are On the Way

There is under development a procedure, or system of procedures, which is theoretically capable of analyzing even the most complex vibrating system. This new method makes use of matrix algebra and calculus, and provides a natural generalization of the methods which were earlier developed by Holzer, Prohl, and Mykelstadt. Current work on the program is being accomplished by Professor E. C. Pestel of the Technical Institute at Hannover, Germany, and by his associates.

What's Available Now?

Unfortunately, as yet there is very little material in the English-language literature on this method, although a book of lecture notes titled *Matrix Methods in the Dynamics of Machines and Structures* has been available from the Engineering Extension Division of the University of California at Los Angeles. A text describing the method in all its details, along with many applications, has been written by Professor Pestel and Professor F. A. Leckie, and is to be published shortly by McGraw-Hill Book Co.

Needed: Accurate Programming

Since the theory and the automatic digital computer calculation procedures are both capable of a high order of accuracy, it is reasonable to hope that *input* data, such as the distributed mass and flexural rigidity, can be evaluated to a comparable degree of accuracy. However, available literature does not seem to contain any experimental evidence that ordinary flexural vibration theory, when applied to the vibration of piping systems, gives accuracy comparable to that inherent in the calculating and theoretical procedures.

Seek Theory, Experimental Correlation

One of the authors, to fulfill the thesis requirement in the curriculum at the U. S. Naval Postgraduate School in Monterey, California, undertook an experimental investigation of this matter[2].

So as to isolate these problems pertaining to the applicability of simple bending theory and the determination of the physical parameters from the

[2]Inasmuch as there were a number of thesis students working simultaneously in this study, and funds for research were limited, it was decided to accept the offer of assistance from Midwest Piping Division, Crane Co., which firm had long been interested in this problem and the help of which is hereby gratefully acknowledged.

problems relating to complex geometry of a piping configuration, it was decided to use the simplest of all possible configurations in the investigation. Therefore, the so-called "free-free" configuration was used, in which the beam is supported at two nodes and is otherwise unconstrained. Not only is the theory of this case quite simple, but also, the experimental realization of this type of constraint is attended with fewer difficulties than would be the case for any other configuration.

Choose Realistic Pipe Size

In actual practice, the vibration of 1 and 2 in. lines poses no real problem, inasmuch as these can be snubbed down by one form of constraint or another with no particular difficulty. It is the vibration of larger systems, such as boiler feed piping, that causes concern.

Accordingly, we desired to perform the experiments on as large a pipe size as could be accomodated in the laboratory space available, and installed a 4 in. standard pipe conforming to ASTM specification A-53, Grade B. Overall length, including ASA B16.9 caps, was 17 ft 2 in.

We took into account theoretical corrections for the presence of the caps at the end of the pipe, and calculated that the points of zero lateral vibration would occur approximately 57 in. from the center. The pipe was supported at these points by standard pipe clamps.

Weight Initiates Vibration

Vibration was excited by suspending a 100 lb weight from the center of the pipe by means of a small mild steel wire. The weight was suddenly released by melting through the wire with a propane torch. Fundamental instrumentation consisted of a pattern of strain gages feeding directly into a strain analyzer, the output of which was led to a direct-inking oscillograph. A four-gage bridge was used for preliminary static testing, but all dynamic tests employed a two-gage bridge. No attempt was made

TABLE 1 — AMPLITUDE OBSERVATIONS made under each of four test conditions. A_o is observation made one second after excitation; other A's are observations made after n, 2n, and 3n cycles had elapsed

Run	Frequency, cps	Amplitude, hundredths in. A_o	A_n	A_{2n}	A_{3n}	Cycles, n	Logarithmic decrement, δ
			Test condition *A*				
1	.....	70.5	55	45	35.5	50	0.0045
2	.....	69	56	45	35	50	0.0043
3	.....	65	51.5	43.5	32.5	50	0.0043
4	.....	65.5	52	43	32	50	0.0043
5	25.2	85.5	73	68	62.5	20	0.0044
6	25.2	83.5	72.5	67.5	62.5	20	0.0040
7	25.2	78	68	64.5	60.5	20	0.0040
			Test condition *B*				
1	.....	75	62	50	38	50	0.0041
2	.....	69	57	43	33	50	0.0046
3	.....	63	53	38	31.5	50	0.0045
4	.....	65.5	55	41.5	33	50	0.0046
5	20.8	84	74	68	62.5	20	0.0050
6	20.8	82	72	63	58.5	20	0.0055
7	20.7	82.5	73.5	67	61	20	0.0051
			Test condition *C*				
1	.....	62	41.5	30	21	50	0.0073
2	.....	61.5	43	34	22.5	50	0.0067
3	.....	66.5	47.5	36	25	50	0.0065
4	.....	63	46	36	24.5	50	0.0063
5	21.0	78.5	66	54.5	49.5	25	0.0066
6	20.8	80	66	54.5	48.5	25	0.0075
7	20.9	79	66	55	48	25	0.0070
			Test condition *D*				
1	.....	61	45	36.5	27	50	0.0054
2	.....	64.5	46	36	27.5	50	0.0058
3	.....	65.5	47	37.5	28.5	50	0.0056
4	.....	66	48	38.5	29.5	50	0.0054
5	18.2	68.5	56	47	40.5	25	0.0073
6	18.2	59	50	42	37	25	0.0066
7	18.2	60.5	50	42.5	37.5	25	0.0071

TABLE 2 — TEST CONDITIONS for the four series of runs conformed to pattern described below

Test condition	Description
A	Bare pipe suspended at calculated nodal points without insulation and without fluid contents
B	Bare pipe suspended at calculated nodal points without insulation but filled with water
C	Pipe suspended at calculated nodal points with insulation applied but without fluid contents
D	Pipe suspended at calculated nodal points with insulation applied and filled with water

to calibrate the strain response. Instead, maximum gain consistent with linearity was employed so as to obtain large records which were easily analyzed.

Analyzation Methods

Analysis of the records consisted, essentially, in determining experimental frequency by counting the number of oscillations in a given chart length and in evaluating the logarithmic decrement so as to assess the damping characteristics of the configuration. That this data is highly consistent is readily evident from an inspection of Table 1.

In Table 1, the A's refer to observed chart amplitudes. A_0 is an observation made at least one second after the release of the exciting weight. This waiting time was involved so as to assure that higher modes than the fundamental had all been sufficiently attenuated so as not to adversly affect the determination of the fundamental frequency and decrement.

The other A's of Table 1 are similar observations made after n, $2n$, and $3n$ cycles had elapsed. The first four runs, under each of the test conditions, were performed with a recorder paper speed too slow for accurate determination of frequency, although they afforded a good determination of logarithmic decrement. The last three runs in each series were made with a faster paper speed which permitted determination of both frequency and logarithmic decrement.

How Test Conditions Varied

Test conditions A, B, C, and D, from Table 1, are further described in Table 2. Actual and nominal values pertaining to the pipe and insulation are shown in Table 3. Finally, Table 4 consists of a comparison of calculated *vs* observed frequency.

The only appreciable discrepancy between the observed frequencies and the frequencies calculated on the basis of nominal properties appeared under test condition C, — a pipe without fluid contents but having external insulation. The explanation for this discrepancy is quite simple.The weight per unit length of the insulation as actually measured was appreciably greater than the value given in the manufacturer's literature. This accounts for a substantially increased calculated frequency.

If our piping system had been permitted to "operate" at an elevated temperature for a reasonable period of time, it is quite likely that the excess moisture which made the difference in weight would have been driven from the insulation, and the observed frequency might very well have corresponded more closely to the frequency predicted on the basis of nominal values.

In case D, the additional weight of the water which filled the pipe tended to mask the discrepancy in the weight of the insulation.

Determine Damping Rates

Table 4 also shows values of the logarithmic decrement calculated from the experimental data. We

TABLE 3 — STRUCTURAL AND GEOMETRICAL DATA for pipe, water, and insulation relative to tests are listed below. Tests concentrated on w/EIg parameter, indicated that that parameter can be evaluated by actual weight and dimension measurement, with consequent accurate prediction of fundamental frequency of vibration

Material	OD, in.	ID, in.	t, in.	w, lb per ft	w, lb per in.	I, in.[4]	E, psi
Pipe							
Actual	4.520[b]	4.038[b]	0.241[b]	11.1[b]	0.924[b]	7.42	30 X 10^6
Nominal[a]	4.500	4.026	0.237	10.79	0.899	7.23	30 X 10^6
Water							
Actual				5.56	0.463		
Nominal[a]				5.51	0.459		
Insulation							
Actual	9.50[b]	4.50[b]	2.50[b]	5.50[b]	0.458[b]	381	2650[c]
Nominal[a]	9.50	4.50	2.50	4.40[d]	0.367[d]	381	3300[e]

[a]Nominal values are those tabulated in catalogs for Schedule 40 pipe and commercially available insulation.
[b]Determined by actual measurement.
[c]Determined by compression test of sample of insulation used.
[d]Approximate weight furnished by manufacturer.
[e]Value inferred from manufacturer's data of compressive load to cause specified shortening.

TABLE 4 — EXPERIMENTAL RESULTS of tests show a comparison of calculated *vs* observed frequency of vibration for the four-part series of tests conducted on the single-pipe structure ("free-free" configuration). Test conditions are identified at left. These results indicate that the w/EIg parameter for pipe structures can be successfully evaluated by actual weight and dimension measurements, and that the fundamental frequency of vibration for a structure can be predicted quite accurately

Test condition	Predicted frequency, cps		Observed frequency, cps	Logarithmic decrement, δ
	Nominal[a]	Actual[b]		
A — pipe alone	25.05	25.07	25.2	0.0043
B — pipe filled with water	20.67	20.72	20.8	0.0048
C — empty insulated pipe	21.36[c] 21.41[d]	20.75[c] 20.80[d]	20.9	0.0068
D — insulated pipe filled with water	18.43[c] 18.49[d]	18.10[c] 18.13[d]	18.2	0.0062

[a]Based on tabulated nominal dimensions
[b]Based on actual dimensions
[c]Employed flexural rigidity of pipe only
[d]Employed equivalent flexural rigidity of pipe-insulation combination

were struck by the fact that neither fluid contents nor external insulation, nor a combination of the two, resulted in any substartial increase in energy absorption over and above that inherent in the metallic pipe and supporting structure itself.

Lateral Accelerations Were Relatively Slight

A rapid calculation from test data showed that the lateral accelerations were less than the acceleration of gravity. This probably accounts for the fact that the fluid contents exerted no appreciable damping influence. If the acceleration were greater than those due to gravity, it is quite likely that fluid contents could serve as an effective energy sink. For this to be the case in actual practice, however, amplitudes of vibration might have to be unacceptably large.

Insulation Has Little Effect

We regarded as both surprising and singificant the fact that the insulation did not absorb more of the vibratory energy. There is a very important conclusion involved here. That is, if there is an energy source which is feeding energy into the configuration at a frequency near one of the resonant frequencies of the piping system, one definitely cannot rely on the damping inherent in the system itself (that is, in the piping, fluid contents, and insulation) to limit amplitudes of vibration to a tolerable level. If these amplitudes are in fact to be so limited, it must be as the result of energy flow out of the system at hangers, supports, constraints, anchors, stays, snubbers, etc.

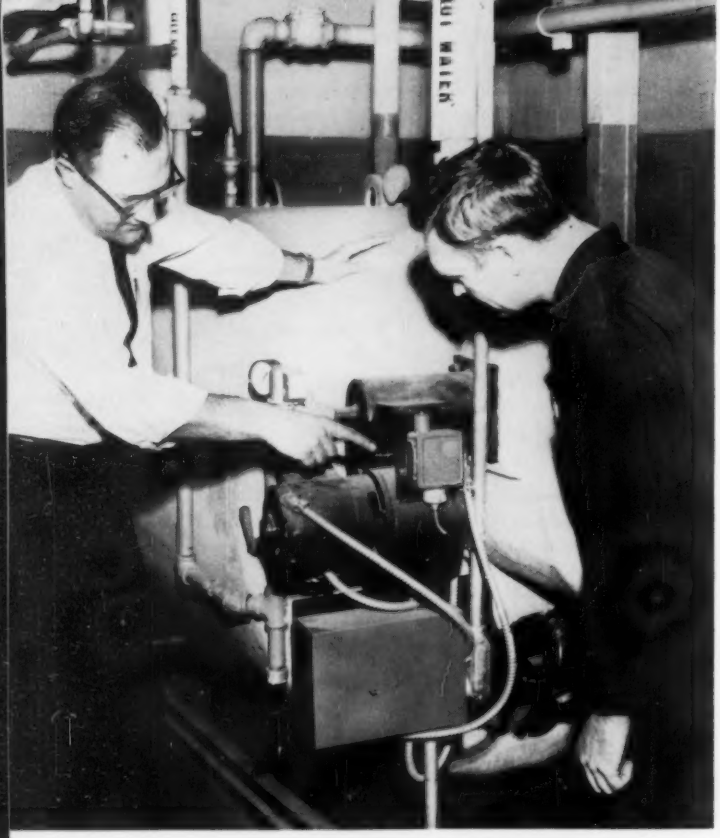
Can Frequency Be Predicted?

Conclusions with regard to the prediction of frequency are probably best stated in the following, taken from the thesis:

"Theoretical prediction of the natural frequency of vibration of a piping system involves a knowledge of its geometry, the nature of the constraints, and the evaluation of some combination of unit mass and flexural rigidity. This study avoided the complications which might be associated with a complex geometry and a complicated system of constraints. Attention was focused on the w/EIg parameter which is important in theory. From this study we can conclude that the parameter can be evaluated successfully by actual measurement of the weight and dimensions, and that the fundamental frequency of vibration can be predicted quite accurately. In addition, while the contribution of the insulation to flexural rigidity can be calculated, if desired, it appears from this study that any contributions from fluid contents or insulation are negligible. It is possibly fortuitous in the case of the pipe used in this investigation that tabulated dimensions and weights gave values very close to those actually measured. Agreement in the case of the insulation is not as good but still reasonable. It is not possible to assert on the basis of anything done in this study that such agreement will always be found. However, it appears reasonable to suggest that, in the absence of more reliable data, good predictions can be made on the basis of nominal dimensions and weights unless there is reason to believe that the actual pipe and insulation in question differ appreciably from nominal."

Study Fundamental Mode Only

In closing, we should probably state explicitly something which has been implicit in the foregoing — namely that this investigation has been confined to a study of the fundamental mode of vibration both for the reason of simplicity of instrumentation and because in practice it is the fundamental which is most likely to lead to intolerable amplitudes of vibration. ∓



By Richard T. Danks
Supervising Engineer
Hospital Sisters of the
Third Order of St. Francis

How to Start a Maintenance School

Is a good maintenance program, like the weather, something that can only be talked about? Or can something actually be done to fight the problem of rising costs and personnel shortages? Does maintenance training have to be a do-it-yourself proposition? Can formal training do part of the job while immediate work still goes on? Is there a way to expand a maintenance training program to include more than one institution or plant?

Hospitals particularly feel the pinch of the maintenance problem. The author, the supervising engineer for some 20 hospitals and related institutions, has initiated a formal-practical schooling project for all members of his engineering staff. One big problem, he says, is how to get such a program accepted by both maintenance and administrative personnel. Here's how it was done.

TOO FREQUENTLY, hospital maintenance or lack of it is dependent almost exclusively on a particular engineer's desires. It is only as good as the man in charge, and accomplished pretty much as he sees fit. This is not to say that hospital engineers are not conscientious and dedicated men — most are, and many have given long years of faithful service in institutions throughout the country.

The problem, however, as has been indicated before in the pages of HPAC, is one of increasing mechanical complication, rising costs, and greater responsibility with, in many cases, no similar rise in the number of man-hours available to cope with these things. The maintenance problem is cer-

tainly not unique to the hospital field, but in hospitals it is particularly aggravated because of the rapid rate of technological advance, and the speed with which the heating, piping, and air conditioning engineer has become responsible for a vast array of mechanical equipment representing more than half the total cost of the medical facility.

Tells One Solution

What to do about it? In the 20 institutions operated by the Hospital Sisters of the Third Order of St. Francis, we have developed what seems to be a reasonable and consistent plan to provide our hospitals with the well-trained and well - motivated operating and maintenance personnel which they require. This is not so much an analysis of how we train, but rather how we got a program started in the first place.

Need Was Obvious

It soon became apparent that one supervising engineer for the hospital chain could not hope to do everyone's maintenance. The immediate need was to acquire at least one good man to head the maintenance force at each institution, and to supply good technicians to round out the rest of the force.

How to Get Them

To successfully pirate such people from other institutions was impossible. The logical alternative was a training program. To initiate a program, however, was not as easy as it seemed. It required a means of acceptance — not only by the people who would be trained, but by those who would be involved in the administration of the program, and those whom the effect of the training would benefit.

We therefore undertook to establish the worth of the program to the satisfaction of all concerned, at the same time as we set up the program itself.

Correspondence Method

We reached the conclusion that because of the relatively few men who would take the course and the geographic spread of the hospitals involved, a correspondence program would be most suitable. We worked (and still do) with the U. S. Department of Labor Bureau of Apprenticeship and Training, the Director of Continuing Education of the Catholic Hospital Association, and representatives of the correspondence school which was chosen to provide the course.

Preparations

Prior to a scheduled meeting with all the hospital Sister Superiors and others in executive positions in the institutions, we prepared and sent to them a fully explanatory paper, the purpose of which was three fold:

1) To describe the problem and its evolution, and to show that it was their problem as well as the engineering staff's;

2) To point out the need for a quick solution;

3) To recommend what we felt was the best solution and tell how that decision could be acted upon.

We began this paper with a simplified explanation of some of the things we have touched upon here — how the complexity and quantity of hospital equipment was increasing faster than the ability of the maintenance crews to handle it — the tremendous increase in investment represented by such equipment — the need for mutual understanding and appreciation of each other's problems between the engineers and others on the hospital staff — and a positive indication (enlightenment perhaps) of the tremendously increased number of services and functions which the hospital engineer is expected to provide without fail today on the same basis used years ago when things were far more simple.

The Hard Facts

This exordium was followed by an analysis of the engineering force, with questions regarding the personnel involved. We asked:

1) Does the chief engineer have the know-how to cope with all maintenance in a modern hospital?

2) Does he have the proper theoretical background upon which to build better understanding?

3) What has been done to keep him abreast of new technology?

4) Is he a leader and organizer?

5) Is he a department head? Can he furnish intelligent reports, participate constructively at interdepartment meetings?

6) Is he of an age when we must think about finding a suitable replacement?

The same questions, we noted, could be asked about the other members of the engineering staff, with these additions:

1) Are there enough men to do the job properly?

2) Are there too many?

3) Do they have the right skills?

4) Do they actually get the job done?

5) Is the work accomplished to the satisfaction of the administration without lost motion?

6) Is it accomplished with a minimum of administrative supervision?

Need for Cooperation

Since we were directing these questions to the administrators, we then asked what *they* were going to do about it if any or all of the questions were answered with a no.

The solutions, as we saw them, involved one or more of a) contractual work with outside concerns, b) a search for and "hiring away" of competent personnel from other institutions, and c) the

training of our own personnel.

The first would be too costly; the second practically impossible. At this point, (we hoped) it would be agreed that a thorough and practical training program was the real answer.

Two-Part Program

We proposed to set up two programs: one for skill improvement among presently employed personnel, and a second apprentice program for people yet to be hired. It was explained that the first, or skill improvement program, would allow our engineers to increase their knowledge with specific emphasis on the concepts of good maintenance. It would also provide for a cross-flow of understanding, since some men were highly skilled in some areas but weak in others. This part of the program was susceptible to a good deal of "tailoring" to meet individual needs, which would make it doubly effective.

Apprentice Training

The second part would be a full-fledged registered apprentice training course covering a four-year term and registered with the U. S. Department of Labor. Formal recognition would give it both status and continuity, attract a better grade of applicant and ultimately help insure a better finished product. This portion of the program would be begun at one hospital under the guidance of a training supervisor and could later be extended to other hospitals if required. From the group of apprentices we expected to obtain men who could be promoted through transfer and who also could be placed in the particular area where they would do the whole facility the most good.

Detail Plan Arrangements

All this was followed by an explanation of the correspondence method of training, the necessary general administration details, and a proposal for a means by which to finance the program (in our case, it seemed best to have the individual pay for his own course of study, subject to a 50 percent reimbursement from the hospital upon satisfactory completion — helping to generate added enthusiasm under the "own money" idea).

Tells Administration's Part

This rather lengthy document was ended with a summation of the requirements for putting a useful training program into effect. Such requirements are extensive, and for proper acceptance had to be fully understood by the people who would supply the administrative, clerical, and supervisory functions that would make the program go.

Meet to Finalize Plan

A meeting of the hospital supervisors with representatives of the Department of Labor and the selected correspondence school followed. A brochure was submitted outlining the notions of correspondence schooling, how it had worked before, what could be expected from it, and the administration of the individual's work. This afforded us an opportunity to reconsider the why's and how's of such a program from the viewpoint of someone experienced as a training director.

Contact Prospective Students

Once we had agreed to initiate the program we could proceed to the question of getting it started, and accepted, among the engineers themselves. We prepared and forwarded to each member of our staff a short brochure outlining some of the material mentioned earlier — the need for advanced study, the opportunities such study could afford the individual, and a boost for the idea of providing the best possible hospital care through the combined efforts of all members of the hospital staff

At the same time, we announced to the hospital administrations that we were contacting the engineers, and cautioned the supervisors that "It is our aim to assist all who really want to improve skills and are not afraid to work. It will take hard work, and unless the prospective trainee sets his mind to do the best he possibly can, it would be better not to start."

Is It Working?

We have had men under instruction for a little more than a year and a half. Experienced training people with whom we are working tell us that all indications are good. However, no real results are to be expected before about three years have elapsed. Changes may be required in the program, but as yet it is too early to tell what these will be. We are ready to change, however, when the need arises.

Everything depends, of course, on the value of the training program being offered. Here, however, we found a surprising latitude for choice among the various recognized national correspondence schools. Such institutions are equipped to provide an almost unlimited variation on course combinations to fill particular needs, as well as expert advice on the content and extent of individual programs.

So far as we know, this particular training program is new with respect to hospitals. Others in the maintenance field have been doing parallel work for some time.

One hurdle, however, has been passed — and it is a high one. The program is off the ground and operating, and on a plant-wide basis that gives promise of providing excellent results. ≠

Photo by Patterson-Kelley Co., Inc.

A review of basic heat transfer principles, an engineering comparison of direct air cooling with cooling by other fluids, an explanation of some fundamental construction alternatives, and a discussion of what can and cannot be changed in fitting the unit to the system — thorough coverage of

Air Cooled Condensers

— how and why they work
— how to select them

By B. L. ROBERTS
Yuba-Aimco Division
Yuba Consolidated Industries, Inc.

THE USE of atmospheric air as a direct cooling medium is by no means a new concept, but its application to industrial cooling requirements has increased tremendously in the past 10 to 15 yrs. This has occurred principally because of the relative decrease in the supply and quality of cooling water, as the demands of civilization place a greater strain on the supply.

The atmosphere, on the other hand, offers a comparatively limitless reservoir for heat disposal, and it is natural that the reservoir be used for the dissipation of industrial heat.

Temperature Difference Is Force

Heat will flow to relieve a difference in temperature just as a fluid flows to relieve a difference in pressure. Any substance may be cooled directly with dry air providing the temperature of the substance is greater than the dry bulb temperature of the air supply.

Technology in the effective use of air as a direct cooling medium has continued to improve, so that more and more applications of heat dissipation by this means are becoming economically feasible. This applies both to industrial waste heat dissipation and to comfort air conditioning.

What's Involved in Cooling Choice?

Therefore it is well for all concerned to understand the principles of direct air heat removal and the design and cost considerations involved.

In general, the following facts should be considered.

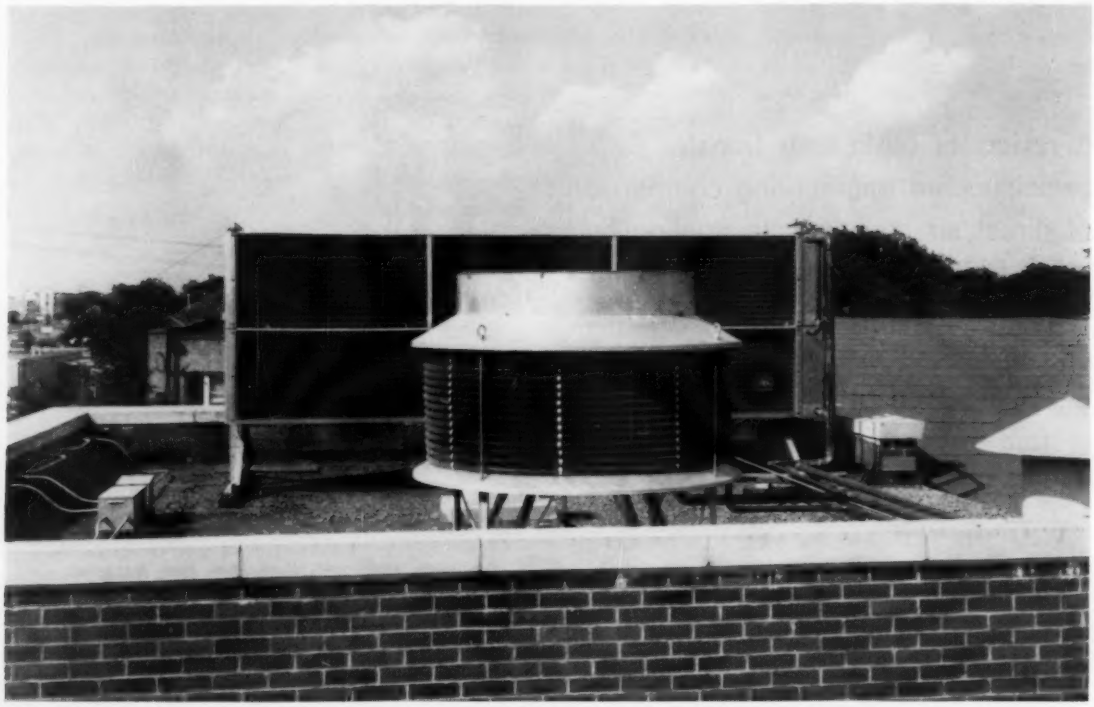
1) Cooling medium cost — including the cost of water treatment that may be necessary, and the cost of obtaining water *vs* "free" air that is untreated.

2) Anticipated maintenance — the possibility of dirt accumulation on the coolant side of water or air equipment which would lead to fouling and a decrease in efficiency.

3) Expected service life — in view of the possibility of corrosive action by the cooling medium.

4) Scheduled care — required in the normal course of operation on a regular basis, and including such things as freeze-up protection, lubrication if necessary, and inspections.

Basic equipment cost can't be considered as the only criterion for selecting the type of system best suited for a given application. A true economic evaluation would require a complete detailed analysis of all the variables mentioned above.



THE SELECTION of air cooled condensing equipment, whether for industrial waste heat disposal or for comfort cooling, as opposed to equipment using some other fluid as the cooling medium, will depend upon a consideration of such factors as the cost and availability of the cooling medium, the one-time and recurring maintenance that can reasonably be expected to be necessary, the likelihood of corrosion — both from the cooling medium and from outside factors. It is apparent that basic equipment cost alone is a poor criterion for equipment selection. Text explains in detail what you should know about air cooled condensing equipment available at the present time

In order to better understand the air cooled condenser as used in comfort air conditioning and industrial cooling, it would be well to review some of the basic fundamentals of heat transfer.

How Heat Is "Exchanged"

In tubular condensers, heat is transferred from the hot medium to the cold medium in accordance with the following formula:

$$Q = UA\Delta t$$

where

Q = total heat transferred, Btu per hr
U = overall coefficient of heat transfer, Btu per hr per sq ft per F
A = total heat transfer surface, sq ft
Δt = temperature difference; the log mean temperature difference corrected for deviation from counterflow

Let's consider each of these.

Temperature Difference

The temperature difference is actually the driving force that causes heat to flow from the hot medium to the cold. For a true counterflow exchanger, the driving force would be the logarithmic mean temperature difference existing between the two fluids. This represents a seldom-reached ideal, and consequently the value must be corrected to adjust for deviation from true counterflow. The magnitude of correction will of course depend upon the degree of deviation.

Multi-Passes, Coil Position Aid Transfer

In air cooled refrigerant condensers, counterflow is approached by designing for the hot medium to make as many passes as possible against the air stream, and by placing the coolest refrigerant (condensate) in contact with the coolest (inlet) air. As noted in the formula, the heat load or capacity of a condenser is directly proportional to the corrected temperature difference.

Heat Transfer Surface

The heat transfer surface area, on which the heat transfer rate is based, can be any area, but for consistency is usually considered as the total outside surface area of the condenser tubing. When extended

air cooled condensers —

TABLE 1 — FILM RESISTANCES to heat transfer for various fluids encountered in refrigerant condensers

Fluid	Resistance range, 1/(Btu/hr-sq ft-F)
Dry gas inside tubes	0.033 to 0.0167
Water inside tubes	0.001
Air over extended surface or fins	0.10 to 0.0667
Condensing refrigerant vapor	0.005 to 0.0025

surface or fins are used, the total extended surface area is considered.

Coefficient of Heat Transfer

This is the rate at which heat will be transferred from the hot medium to the cold, and is the reciprocal of the summation of the resistances to heat transfer that exist within the system.

A simplified method for expressing the rate in terms of the individual resistances is

$$U = 1/R = 1/(r_i + r_o + r_m)$$

where

R = total resistance to heat transfer
r_i = film resistance of fluid inside tube
r_o = film resistance of fluid outside tube
r_m = resistance offered by tube metal

The individual film resistances r_i and r_o are dependent upon the physical properties of the individual fluids, the environment temperatures and pressures, the rates of flow, and the physical characteristics of the heat transfer apparatus. Table 1 lists the relative resistance values normally encountered in refrigerant condensers.

Why Fins Are Used

If there is a wide variation between the film resistances offered by the two fluids in use, design efficiency can be improved by the use of extended surface, or fins. The fluid which offers the highest resistance is always placed in contact with the extended surface, or in other words, with the greatest area. This tends to equalize the effective resistances, and since extended surface is usually less expensive than bare surface, the cost of the unit tends to decrease.

For this reason, almost all air cooled condensers include high fin tubing, and water cooled units use low fin tubing. The ratio of finned surface to bare surface that should be established depends upon several factors, including the ratio of the film resistances and the heat transfer efficiency of the extended surface.

What Determines Fin Efficiency?

This efficiency factor depends upon the thermal conductivity of the fin material, the size and shape of the fin, and the heat flux or flow density. In general efficiency increases with an increase in fin thickness, and decreases as the fin height (distance from the base tube) increases. A complete mathematical treatment of this subject has been published[1].

Another factor in fin efficiency is the bond resistance or heat transfer resistance offered by the bond between fin and tube. Bond efficiency increases with an increase in contact area or contact pressure.

For air cooled condensers using extended surface, the heat transfer equation should be adjusted as follows:

$$U = 1/[r_o + (r_i \times A_o/A_i) + (r_m \times A_o/A_m)]$$

where

A_o = total outside (finned) surface area, sq ft
A_i = inside surface area of tube, sq ft
A_m = average or mean surface of the heat flow path through the metal tube wall

The fin surface efficiency is normally introduced as a correction or adjustment to r_o. One method may be shown algebraically as follows:

$$r_o = [(r_a \times A_b) + (r_a A_f/\Omega)]/A_o$$

where

r_o = corrected air side film resistance applicable to surface A_o
r_a = actual calculated resistance of the air film
A_f = total finned surface
A_b = total bare surface exposed to air
A_o = total outside surface ($A_f + A_b$)
Ω = fin surface efficiency

How Air Cooled Condensers Perform

In air conditioning applications, the air cooled condenser performs exactly the same function as would a water cooled or evaporative unit. This function is to de-superheat and condense the refrigerant vapor on the discharge side of the compressor, or in effect to dissipate the heat absorbed by the evaporator plus the heat added in the compressor. For practical purposes, compressor heat will consist of the heat of compression plus the heat generated by friction within the compressor, and, for suction cooled compressors, the additional heat required for cooling the motor windings.

Compression Effect on Refrigerant

In order to prevent liquid slugging of the compressor, the refrigerant should always enter the suction side in the vapor state, preferably with some degree of superheat. Although the action of the compressor increases the environment pressure of the refrigerant vapor and, in turn, the temperature at which the vapor will condense, the refrigerant must always leave the compressor discharge as a superheated vapor, due to the heat which is absorbed at

[1]Gardner, K. A., *Transactions, ASME*, 67, 621-632 (1945)

TABLE 2 — CALCULATED VALUES for Refrigerant 22 systems using typical compressors show condenser heat exchanger to be actually a desuperheater-condenser rather than true condenser

	Type of compressor			
	Open	Suction cooled	Open	Suction cooled
Saturation temp at evaporator, F	40	40	0	0
Saturation pressure at evaporator, psia	83.68	83.68	38.78	38.78
Compressor suction pressure, psia	82.0	82.0	37.0	37.0
Compressor suction temperature, F	65	65	65	65
Compressor discharge pressure, psia	277.2	277.2	277.2	277.2
Condensing temp (saturation) at compressor discharge pressure, F	120	120	120	120
Calculated refrig. vapor temperature at compressor discharge, F	179	220	243	335

the compressor. Table 2 gives calculated values of system temperature and pressure using Refrigerant 22 and compressors typical of those in common use.

From the information in Table 2, it is apparent that the heat exchanger is actually a de-superheater/condenser rather than a true condenser. Relatively unimportant for water cooled units, this fact is of major significance for air cooled condensers.

Dry Gas, Liquid Heat Transfer

The refrigerant vapor enters the condenser as a superheated dry gas, which will remain dry and which will have the dry gas heat transfer characteristic until it comes in contact with a surface (tube wall) temperature equal to the saturation temperature of the vapor at operating pressure. At this point, the surface or tube wall becomes wetted with refrigerant liquid, and subsequent de-superheating is accomplished by re-flashing of condensed liquid at the tube wall into the bulk vapor. After the tube wall is wetted, heat will be transferred at a condensing rate and at a corrected log mean temperature difference corresponding to the saturated condensing temperature.

Tube Wall Temperatures

In any condenser, the temperature of the tube wall will tend to be closer to the bulk temperature of the fluid having the lowest effective resistance to heat transfer. An analysis of the resistances shown in Table 1 will explain why:

1) In a water cooled condenser, the tube wall temperature will be closer to the bulk temperature of the water than to the bulk temperature of the refrigerant (dry gas) in the de-superheating zone, and

2) In an air cooled condenser, the tube wall temperature will be closer to the bulk temperature of the refrigerant (dry gas) than to the bulk temperature of the air.

In addition, cooling water temperatures are normally lower than cooling air temperatures. From this, it is obvious that the wet wall condition will be reached much earlier in the water cooled condenser than in the air cooled. Thus, the de-superheating zone is relatively less important with water cooling, and has less effect on the overall heat dissipating ability of the condenser.

Performance In Superheat Zone

In an air cooled condenser, the heat transfer rate, U, is normally greater in the condensing zone than in the de-superheating zone. However, the high refrigerant inlet temperature caused by superheat results in a higher temperature difference or driving force in the de-superheating zone, and the ratio of temperature differences is greater than the ratio of heat transfer rates.

Since Q is directly proportional to the product of $U \times t$, total heat transfer will be greater per unit of area in the de-superheating zone than in the condensing zone.

How Is Capacity Affected?

It follows, then, that an increase in the percent of superheat to be removed at the condenser will cause an increase in the actual performance capacity of the condenser and vice versa. The magnitude of this increase or decrease will depend on all the design variables, and will not necessarily be the same for any two condenser designs. However it can be predicted mathematically for any given design.

Beware of "Capacity"

To simplify condenser selection, many manufacturers have published condenser capacities based upon Btu per hr at the evaporator. The idea behind this method is commendable, but we suggest that the results can cause considerable difficulty. It is absolutely impossible to predict the capacity of a con-

air cooled condensers —

Suggestions on the Selection of Air Cooled Equipment

Air Cooled Condenser

Always select on the basis of the condenser heat rejection required and identify the following variables in your selection:

1) Design ambient air temperature

2) Desired condensing temperature at design ambient

3) Type of compressor used (open or suction cooled) and design evaporator conditions

4) Type of refrigerant

5) Altitude (if installation is to be made at high altitude).

When estimating the required heat rejection at the condenser, always consider the type of compressor. For open type compressors, the heat rejection required at the condenser is

$$Q_c = (12{,}000 \times TR) + (2545 \times bhp) - \Sigma_q$$

where

Q_c = total heat rejection, Btu per hr

TR = tons of refrigeration

Bhp = brake hp to compressor

Σ_q = heat transferred to compressor water jacket, oil cooler, or lost to the ambient air from the compressor body or discharge line.

For suction cooled compressors, the additional heat added by the electric motor must be removed at the condenser; therefore the above equation must be modified as follows:

$$Q_c = (12{,}000 \times TR) + (3413 \times KW) - \Sigma_q$$

where

KW = kilowatt input to the compressor

The term Σq is relatively insignificant and can be neglected for compressors that do not incorporate artificial means of cooling.

Never use the term "TD" unless it is associated either with the design ambient temperature or the design condensing temperature.

Never select on sq ft of surface. As previously discussed, the amount of surface required for a given capacity depends upon the efficiency of the surface, the amount of air over the condenser and many other variables. The same results can be accomplished by using different combinations of these variables. Restrictions of this type could unfairly limit your choice, excluding some equipment which could well suit the intended purpose.

Air Cooled Condensing Unit

Always select on the basis of the capacity required at a given evaporator temperature and design ambient temperature.

Never consider only the compressor hp without additional qualifications. Fig. 1 and Table 3 in this article show obvious reasons for more elaborate considerations.

In addition to the initial equipment cost, proper consideration should be given to the following factors:

1) Operating cost (evaluated as KW/TR)

2) Expected service life in view of the relative stability of the basic design, tube gage, fin thickness, number of solder connections, etc.

3) Effect of high or low wind velocities on equipment performance in the light of the proposed location, prevailing winds, etc., to determine the desirability of horizontal or vertical discharge.

4) Equipment weight, ease of handling, etc.

5) Installation costs, including foundations, piping, controls, and any required field sub-assembly.

6) Equipment appearance.

7) When analyzing condensing units, compare the compressor capacity as published by the manufacturer with the stated capacity for the condensing unit.

denser as heat load at the evaporator without first defining the compressor that will be used in the system.

The ratio of heat rejection at the condenser to heat load at the evaporator will vary with the compressor model and with the type of compressor — suction cooled, open type, and so forth.

Another fallacy is that condenser capacity can be predicted as a function of and is directly proportional to "TD," the difference in temperature between the saturated condensing temperature of the refrigerant and the ambient air temperature. "TD" should never be confused with $\triangle t$ or the corrected log mean temperature difference used in heat transfer calculations. The two are related to some degree, but are by no means proportional.

Post-Selection Alternatives

Once a condenser design is selected, the following variables, are, for the most part, fixed:

1) r_o — air side film resistance including fin and bond efficiency

2) A — heat transfer area

3) Air quantity

4) r_m — tube metal resistance.

Since these *are* fixed, the only remaining variables are the refrigerant side of the system and the ambient air temperature.

If ambient air temperature is decreased, then capacity must be increased. Air quantity is fixed, so an increase in capacity means a higher temperature rise on the air, which tends to decrease the relative $\triangle t$. It's clear then that changing "TD" does not necessarily cause a direct proportional change in capacity. It can be shown that, with a fixed ambient air temperature, any given air cooled condenser will have a different capacity with each of the four sets of conditions described in Table 2. It can also be proven that doubling the "TD" by varying ambient air temperature will not result in doubling the condenser capacity. In other words, "TD" is not directly proportional to capacity under any circumstances, and therefore should not be used as a term of reference.

What Changes Performance?

The following variables actually do affect the performance capacity of an air cooled condenser, once the condenser has been designed or selected:

1) A change in the refrigerant flow rate (lb per hr) to the condenser.

2) A change in the quality of the refrigerant. This may be done by changing suction or discharge conditions, or both. Any change in the pressure and/or temperature of the refrigerant at the condenser inlet would be a change in refrigerant quality.

3) A change in ambient air temperature at the condenser.

Published capacities for air cooled condensers should be stated in such a manner that the rejection capacity could be predicted for any given set of conditions.

For practical purposes, the refrigerant quality at the condenser inlet can be established by defining the compressor suction conditions, saturated condensing temperature, and the type of compressor (suction cooled or open type).

Since these conditions also establish the Btu per lb enthalpy change required across the condenser, the lb per hour of refrigerant flow is a function of the heat rejection required.

It would therefore be necessary to publish capacities as a function of the following variables:

1) Ambient air temperature

2) Saturation temperature or pressure at the evaporator

3) Compressor suction (temperature and pressure)

4) Saturated condensing temperature

5) Type of compressor (suction cooled or open)

6) Type of refrigerant.

Integration in the System

Although an air cooled unit performs exactly the same function as does a water cooled or evaporative unit, an error in selection can in many cases cause more serious difficulties.

The use of air as the cooling medium usually requires higher operating pressures and temperatures than those normally encountered in water cooled or evaporative systems. A poor choice of condenser could result in compressor discharge temperatures and pressures high enough to damage the compressor and cause complete failure of the system.

In addition to reliability, the operating cost of a system is greatly influenced by condenser selection. There are far too many variables to predict with accuracy the actual heat load that will be required from an air conditioning system over a long period of time. It is possible, though, to predict the relative power consumption required for any two or more systems that are being considered. If we assume that either system would handle the load, the relative number of actual operating hours required would depend upon the relative capacities of the systems. An operating cost analysis can then be made based upon the power input requirements.

Fig. 1 and Table 3 constitute an analysis of three Refrigerant 22 systems, with operating curves and a tabulation indicating relative performance characteristics. Each system is designed with the same compressor, evaporator, expansion valve, etc.; only the condenser is different.

Basic design is for 95 F ambient air to the condenser, but performance characteristics are shown for both 85 F and 115 F ambient air. In order to simplify the analysis, it is assumed that expansion valve and evaporator sizes and designs are such that constant conditions will be maintained as follows:

1) 40 F saturation temperature at evaporator

2) Approximately 2.0 psi suction line pressure drop

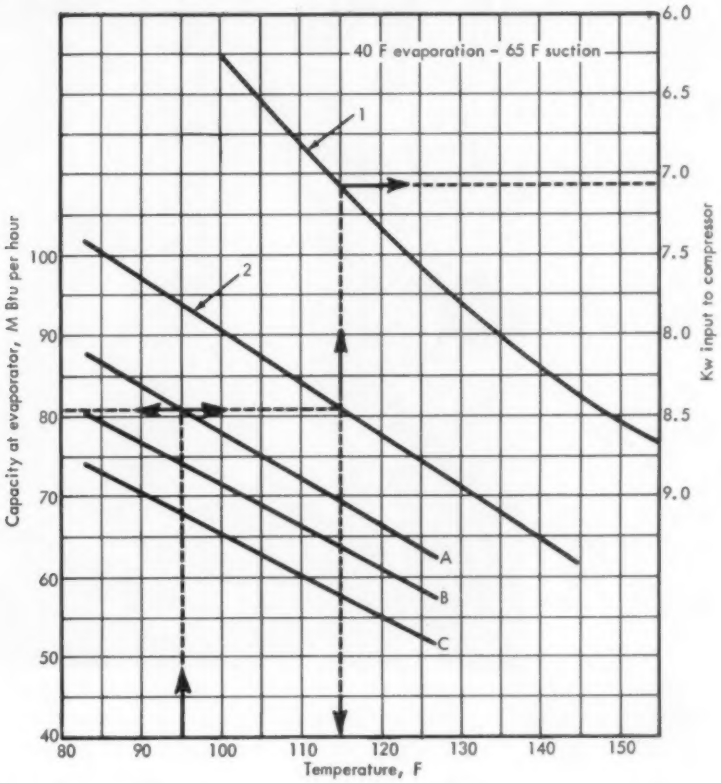
3) Suction vapors superheated to 65 F.

The individual curves shown in Fig. 1 are

Curve 1: compressor Kw input *vs* saturated condensing temperature.

Curve 2: compressor capacity, Btu per hr at evaporator, *vs* saturated condensing temperature

Curves A, B, and C: air conditioning system capacity, Btu per hr at evaporator, *vs* ambient air temperature.



1 COMPARISON of three Refrigerant 22 systems is effected at right and in Table 3, below. Curve 1 is compressor Kw input *vs* saturated condensing temperature; Curve 2 compressor capacity at evaporator *vs* saturated condensing temperature. Curves A, B, and C represent system capacity *vs* ambient air temperature

TABLE 3 — PERFORMANCE ANALYSIS of three Refrigerant 22 systems, each with identical compressor, evaporator, expansion valve, etc., but with different condensers shows direct influence of condenser on efficiency of the system

	System A			System B			System C		
Ambient air temperature, F	85	95	115	85	95	115	85	95	115
Capacity at evaporator, Btu per hr	86,500	81,000	69,000	79,000	74,000	63,300	72,300	68,000	58,200
Saturated condensing temperature, F	106	115	133.5	118	125	141.5	128	135	149.5
KW input to compressor	6.55	7.01	7.97	7.175	7.525	8.29	7.70	8.00	8.58
KW per TR*	0.908	1.038	1.385	1.090	1.220	1.570	1.278	1.435	1.767
Relative power requirements, percent**	100	100	100	120	117.5	113.3	140.5	138.	127.5
Compressor discharge pressure, psig	215.97	245.18	313.50	255.49	280.68	346.72	291.98	319.56	382.27
Compressor discharge temp., F	197	210	242	216	228	257	233	244	272

*Kilowatts input at the compressor per net ton of refrigeration at the evaporator; TR Btu per hr at evaporator/12,000
**Expressed as a percentage of the power required by System A

The three systems are defined as follows:

System A: Basic design for 115 F saturated condensing temperature with 95 F ambient air.

System B: Basic design for 125 F saturated condensing temperature with 95 F ambient air.

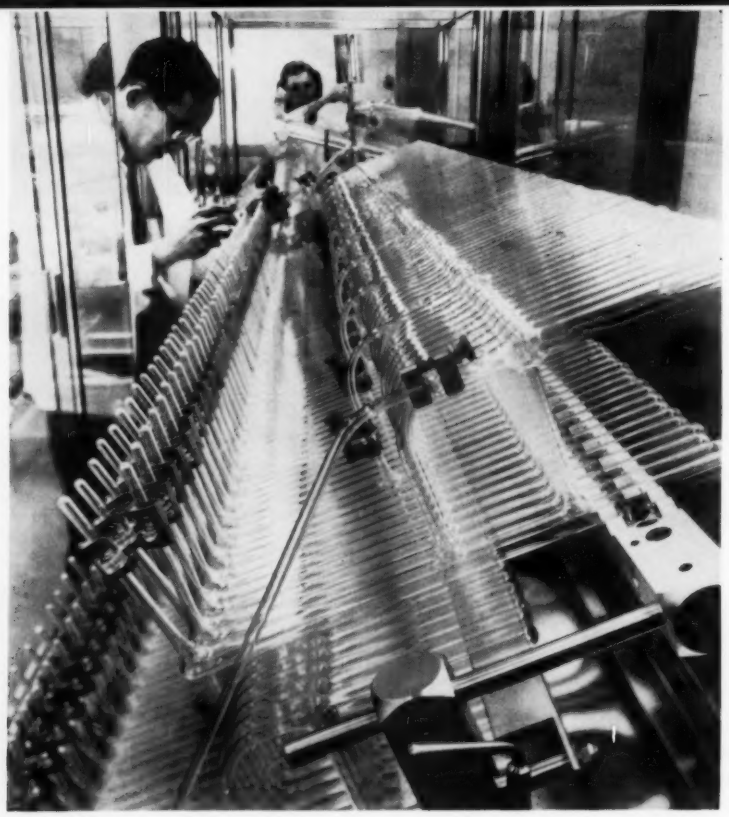
System C: Basic design for 135 F saturated condensing temperature with 95 F ambient air.

Since the three systems are identical except for condenser selection, the values given in Table 3 indicate the direct influence of the condenser on the efficiency of the system.

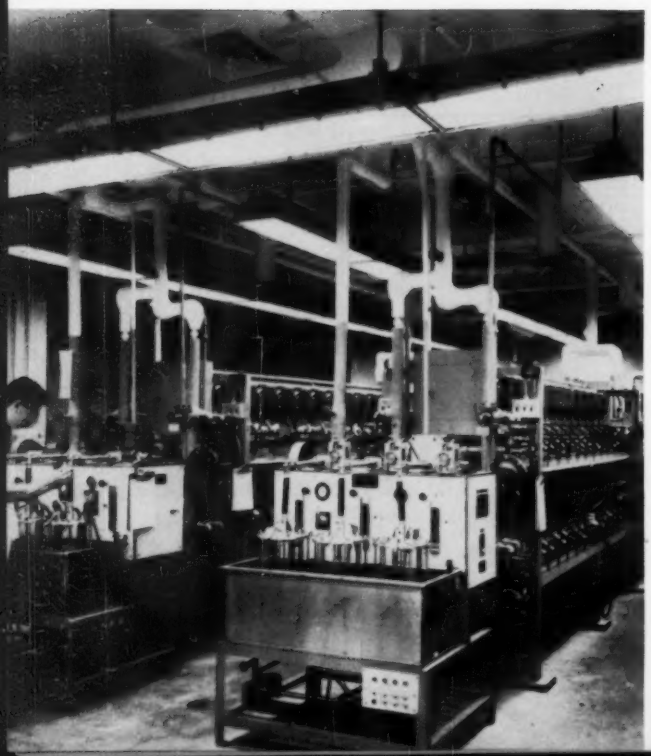
A performance chart similar to Fig. 1 can be prepared for any combination of compressor and condenser and for any evaporator conditions. Performance characteristics are obtained from the chart by entering at the ambient air temperature and proceeding as indicated by the dotted lines.

Some Conclusions

In summation, a change in the operating conditions usually affects the performance of an air cooled condenser in the same direction as it affects a water cooled condenser, but not necessarily to the same degree. An understanding of the effect of these variables on the general quality of the system will help the engineer to arrive at the most economic selection for a given application. The most desirable system is not necessarily the one with the lowest initial equipment cost. ‡



Mechanical Designs Aid Research for Better Drugs



By LEWIS SMITH
Heating Engineer

THE GOAL of the medical research personnel employed by Chas. Pfizer and Co., Inc., at Groton, Connecticut is "the creation of new and better drugs through organized knowledge."

Better drugs presuppose thorough and closely controlled investigation under the best possible test conditions, and consequently that company has constructed new research facilities adjoining its production plant.

Occupied in late 1959, the Medical Research Laboratories building is a two and three story structure of 177 thousand sq ft floor area, of which 95 thousand sq ft are devoted to laboratories, work areas, biological stock rooms and animal rooms. Besides

FERMENTATION lab air distribution system is partially visible at left

• A combination of high pressure dual duct and hot water heating and air conditioning systems plus a total of 10 separate piping systems serve a new medical research laboratory in Connecticut. Individual exhaust provisions to prevent cross contamination in animal rooms and other critical areas are an integral part of the air conditioning design. Sectionalization will allow future expansion without interrupting important work.

these, the building also provides space for a 300 seat cafeteria, a meeting room for 150, a 7000 volume library, and other facilities.

Design Meets Special Needs

Because of the great variety and complexity of the work carried on here, piping and air conditioning systems had to represent the "ultimate" in environmental control, including protection against bacteriological contamination from space to space.

The interior of the building is divided into numerous areas, ranging from 30 small laboratories for individual research to large spaces for mass research, for animals, and for storage of samples. Each such space, large or small, must be accurately controlled for temperature by both automatic and manual means, and in the animal rooms it is equally important to control humidity as well. In the latter spaces, separate air conditioning systems are provided to maintain constant conditions on a 24 hr a day basis.

Finally, in many areas there must be no transfer of air from room to room in order to prevent cross contamination. Thus, each space also has its own exhaust system with a capacity about five percent greater than the air supply. Corridors are pressurized to help maintain an overall positive building pressure.

Extensive Piping Arrangements

There are no less than 10 separate piping systems for the laboratory areas. These are

1) Compressed air at 15 psi
2) Sterile, oil-free compressed air for fermentation equipment, from carbon ring compressors
3) Vacuum, with 20 in. Hg at the outlets
4) Gas, from a liquefied petroleum gas storage facility in the main plant
5) Cold water from the municipal system
6) Hot water for general cleaning
7) High pressure water (100 psi) for aspirators used in vacuum distillation
8) Chilled water
9) De-ionized water, which is also piped to a central still and re-distilled into "ultra-pure" water
10) Steam at 5 psi.

Waste Was Problem

All these systems use standard grades of pipe for the particular service. Drains, however, required spe-

MEDICAL RESEARCH LABORATORY building is divided into numerous use areas, has 10 separate piping systems, combination dual duct and hot water heating and air conditioning for labs, animal rooms, administration spaces, etc.

cial consideration because of the corrosive action of the waste materials. For this reason, risers and mains are of high silicon cast iron, but the 1-½ in. branches from laboratory sinks to the risers, including the traps, are of a special plastic construction developed to resist damage from any anticipated solvent present in the waste. All waste is passed through a limestone filter bed and is then piped to the city sewer system in a neutral condition.

Plan for Utmost Dependability

Present capacity of the air conditioning system is 1100 tons, supplied by a pair of 550 ton absorption units arranged so that a third chiller can be installed for future expansion with no interruption of service. (This characteristic of non-interrupted service is extremely important, and was influential in the design of the entire complex. For instance, the process steam system is sectionalized for breakdown protection.)

Use Dual Duct, Hot Water Combination

Comfort air conditioning systems are designed for 78 F dry bulb temperature with 50 percent relative humidity when outdoor temperatures are 95 F DB and 75 F WB. No recirculation of air is permitted. A hot water heating system with convectors supplements the air system. The former is designed to maintain approximately 50 F inside when the outdoor temperature reaches zero, with the balance of the heating supplied from the air system.

Six Systems for Comfort

Five high pressure dual duct systems, designed to operate with 8 to 9 in. WG at the fan outlets, plus one low pressure multi-zone system are used for the general spaces. Two of the high pressure systems serve constant temperature areas, which include a number of animal rooms. Air distribution is via overhead diffusers from constant volume dual duct mixing boxes. All fans for air conditioning are located in two machine rooms. In each laboratory space, temperature is controlled by means of individual room thermostats, and all systems include electrostatic air filters.

Special Exhaust Provisions

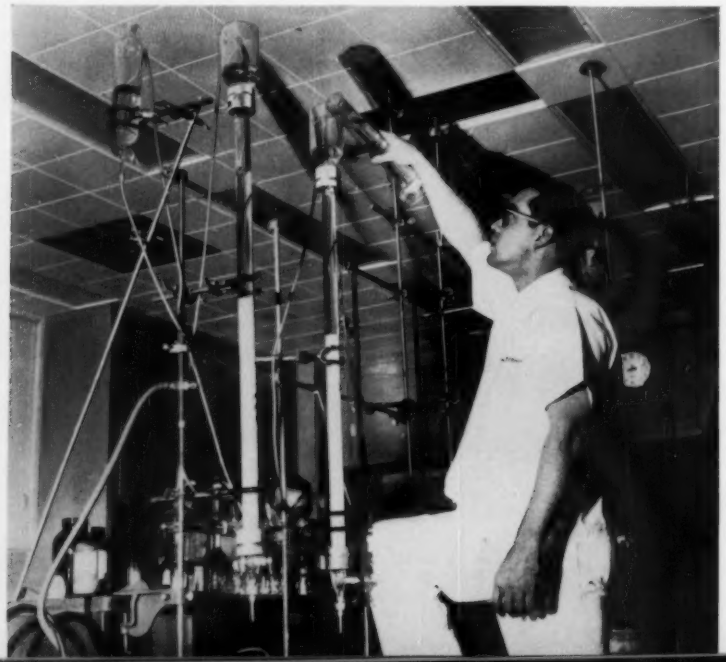
Since 100 percent outside air is needed for all areas where there is any danger of cross contamination, air from those spaces is exhausted through individual fume hoods which are coated to minimize corrosion, and also through conventional room exhaust systems. Most of the ducts for exhaust are of non-metallic materials. Fan blades for each of the more than 100 exhaust hoods are also coated for corrosion prevention. The fans are actually located in a continuous monitor on the roof.

Interlock Exhaust, Supply Functions

Because the fume hoods are an integral part of the design and operation of the air conditioning systems, they are so constructed that as the sash of any test enclosure is lowered, a bypass is uncovered to maintain the air balance in the room.

All fan motors are wired to control centers so that the operating engineer can exercise remote control. Each hood also has a local start-stop switch for laboratory control.

Mechanical and electrical engineers for the project were Jaros, Baum & Bolles. Kerby Saunders Inc. was the air conditioning contractor. ⧺



MULTITUDE of small laboratory and larger spaces for mass research, animal quarters, etc., are each supplied with conditioned air on a carefully regulated, non-recirculation basis

Heat Recovery Methods Can Produce Huge Savings

HEATING, air tempering, and air conditioning loads in modern industrial plants have become enormous, and the operating costs alone for some of these systems may exceed $500,000 annually. In addition, the cost of the equipment for these installations may be very great. In the profit squeeze of today's economy it is of great importance that equipment and operating costs be kept to a minimum by all practical means of heat recovery and conservation.

Tell How To Do It

A number of successful methods to achieve desirable results were revealed in the Industrial Heat Recovery Forum at the recent meeting of the American Society of Heating, Refrigerating, and Air-Conditioning Engineers in Denver. It was concluded that huge savings can be made if even a portion of the heat can be recovered from exhaust air, steam condensate, cooling water for condensing purposes and the many other applications in today's industrial plants.

One heat recovery method that seems to hold some promise is the use of catalytic burning in order to recover large quantities of heat in exhaust air, especially when such air contains industrial solvents. One such system was described which is in use in a metal packaging plant. Air at a temperature of 350 F is exhausted from drying ovens and is introduced into a catalytic burner where the temperature is raised to 650 F by means of gas burners, starting the catalytic operation. Solvents are burned off and the air temperature is increased as it passes through the burner. This heat is recovered by means of coils in the exhaust stack which deliver a glycol solution to air preheating coils in the ventilation air supply to the building.

While this system is costly, it has been found that sometimes the cost can be justified, especially if there are odor and other air pollution problems causing complaints in the area.

Untreated Makeup Air

In a foundry, savings in makeup air delivered to exhaust hoods resulted when it was decided to introduce outdoor air directly into the hoods without heating or treating it. Of the amount of air exhausted from the hoods, the raw outside air represented about 70 to 80 percent of the total. The remaining portion entered hood enclosures from adjacent plant areas.

Reusing Makeup Air

In another plant a cost study revealed that about $40,000 in equipment costs could be saved if the building exhaust air could be filtered and recirculated rather than wasting it. In addition to this the operating cost with the recirculated air plan was about $1300 less for one yr. In this connection, it was mentioned that in the last two yrs several plants in the central states have adopted systems of collecting makeup air, filtering it, and reusing it with appreciable savings.

Treatment for Hood Air

Some discussion also took place on the subject of bringing partially treated air to exhaust hoods and the possible effect that this has on

— ideas on heat recovery

the air distribution within the plant or laboratory under various conditions of supply to the hood.

Saving Equipment Heat

Another heat recovery method which has resulted in savings is that of using heat picked up from cooling large motors and generators. Of course such air must be filtered before passing through the motors and generators. In the summer the hot air is exhausted to the outside.

On a question raised about the use of heat from incinerators, it was mentioned that the flow of trash from many commercial establishments would normally be enough to heat the outdoor ventilation air during occupied periods.

It was reported that the City of Milwaukee uses waste heat boilers fired by their incinerators. The heat is delivered to a garage and another building, but supplemental heat is required when the incinerator is not operating.

It was concluded from this phase of the discussion that a careful correlation must be established between the amount (and heat content) of the trash to be burned, plant heat requirements, and the times when heat will be needed *vs* the times when trash will be available. Also the cost of supplemental heat, if required, must be considered.

Steam Waste

Another source of heat recovery that was explored in the forum was the use of waste condensate and flashed steam. It was brought out that much of this condensate and steam could be used in many plants if a satisfactory load were close enough to justify the cost of recovering the heat and piping it to the area where it could be used. In some cases waste heat of this type has been used to preheat air with considerable savings.

One application of heat recovery was mentioned that involved the use of panels with copper tubes attached to the lights in large office buildings. The heated water at a temperature of about 60 F is used in reheat and preheat coils.

Another point brought out in the discussion was concerned with local codes and what could be done to up-date them so they would reflect current practice. At present many codes require more than adequate ventilation systems resulting in excess boiler requirements. Since this excess equipment is expensive to operate, a waste in first cost results if it remains idle.

Other Sources

The subject of solar heating was also discussed as a means of heat recovery. The control of these systems is generally quite intricate, however, because of the complexity of the system and the need to tie in with a supplemental system.

Well water is another source of heat recovery and storage that has been used in some areas where water can be pumped from one well to another in one season and the flow reversed in the other season.

Design Improvements

The importance of "downgrading the air" to recover as much heat as possible was another point mentioned. This can best be accomplished in the design stage by arranging to deliver air from one area to the next, each time using the air several times to provide necessary ventilation for areas of "lower levels." For instance, air can be delivered from office to factory, then to locker areas and then to toilet areas before being exhausted to the outside.

Another suggestion for recovering waste heat or for utilizing the heat available more effectively was to remove the air from the floor and discharge it up into high ceiling areas causing the heated air to be forced down. This method has been used successfully in some plants with a no-draft result. The method is also applicable in plants where the heated air is discharged high and does not get down into the occupied areas without some aid, and for the recovery of heated air near the ceiling which would otherwise be wasted.

More On Hoods

Another hood application mentioned involved a number of large hoods for new laboratories where 79 air changes per hr are required. This means that a total of 250,000 cfm of conditioned air will have to be delivered and exhausted to the outdoors unless some recovery methods are used. A study showed that the total first, or equipment cost per cfm in this case would be about $4.50 for supplying the conditioned air and for exhausting this air after it had been used just once. This represents a cost of $3.50 per cfm for conditioning the air and $1.00 per cfm for air handling equipment alone.

In this case, as in many, today's design not only must serve today's needs but must anticipate the needs of tomorrow, and at the same time save as much in operating costs as possible.

Discussion Summary

Some of the main points brought out in this discussion may be summarized as follows:

For air conditioning and cooling installations:

a) Improve the building design by insulating, vapor proofing, reducing glass areas and reducing

infiltration losses.

b) Improve process and equipment design to reduce heat release. Insulate hot equipment and piping.

c) Recirculate air wherever possible. Filter and purify recirculated air as necessary and where permitted.

d) Reduce make-up air requirements by careful design of hoods and other equipment requiring air. Bring uncooled air directly to the hoods and processes requiring make-up air. Use air from adjoining cooled spaces for make-up purposes.

e) Operate for economy by keeping the supply of outdoor air being delivered to the systems to the minimum and by shutting down when possible.

For heating and make-up air tempering:

a) Reduce the make-up air requirements by careful design of hoods and other equipment requiring air. Whenever possible, bring in raw air directly to the hoods or processes requiring the air.

b) Mix the supply air with hot building air.

c) Pass the supply air through a heat exchanger to recover process, equipment, or engine heat. Exchangers may be hot air to air, hot gases to air, or hot liquid to air.

d) Heat the air by cooling processes or other equipment.

e) Recirculate air whenever possible. Filter and purify where practical and wherever permitted. Downgrade the air by using it from adjacent areas wherever possible.

f) Operate for economy. Keep the supply air quantity and temperatures to the minimum. Shut the systems down whenever it is safe and practical to do so.

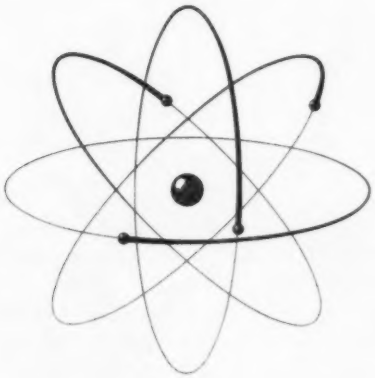
Rule of thumb engineering has no place in the design of modern plants. It is far too costly. Doubling the air volumes, just to be sure, can be a costly approach also. The time spent on good sound engineering will return good dividends in economy.

New ideas and methods are needed constantly. ⧺

Piping Code Committee Interprets Nuclear Valve Case

● Since the Code for Pressure Piping, ASA B31, was last issued, the Sectional Committee on the Code has been asked to interpret various statements contained therein. While these cases represent the opinion of the committee, they will not become parts of the code until formal action has been taken.

The following case, N-2, dealing with the requirements for valves used in nuclear piping systems, has been released for publication.



Case No. N-2 — Requirements for Valves Used in Nuclear Piping Systems

Inquiry: What are the requirements for valves used under the rules of ASA B31.1 in nuclear piping systems?

Reply: It is the opinion of the committee that valves used in nuclear piping systems must meet the following requirements:

1) Be of materials recognized by ASA B31.1, Section 1-1955 and code cases prefixed by "N" as satisfactory for the specified service. They shall, wherever possible, conform to a recognized standard, such as ASA B16.5.

2) Valves must at least meet the physical and inspection requirements of Case N-10 for cast austenitic materials.

3) Have some sort of positive sealing (such as capped, welded, bellows, diaphragm, double packing with lantern gland) or some other provision for stem and bonnet leakoff control which reasonably assures that leakoff can be contained within the main or auxiliary nuclear piping systems. This restriction does not apply to valves 2 in. and smaller when used in water and steam service provided that valves are of backseating type.

4) Screwed end valves in which threads provide the only seal are not permitted in nuclear piping systems. ⧺

How Does Altitude Affect Performance Of Heating and Air Conditioning Equipment?

WE ALL REALIZE that differences in altitude have an effect on the performance of heating and air conditioning equipment, but can we always predict what this effect will be?

This was the main question under consideration at one of the Forums in Denver during the recent meeting of the American Society of Heating, Refrigerating, and Air-Conditioning Engineers.

Factors for Special Care

It was brought out that the engineer designing systems for high altitude locations should always specify very clearly the air flow rate and static pressures expected for the particular altitude conditions. The same applies to the selection of coils and fan-coil units. It was apparent from the discussion that correction methods for determining performance have to include a consideration of pressure changes, temperature changes, latent heat and sensible heat. However, it was pointed out that in order to make these interpolations for performance, psychrometric charts for two or three elevations are needed. Some manufacturers have these charts available, and ASHRAE charts for altitude correction are also being developed. It was also noted that a suitable method for correcting for altitude conditions on cooling coils is needed.

Performance Should Be Certified

One consulting engineer stated that performance standards are always included in his plans and specifications, which also require that the mechanical contractor test the system after installation. In this way, some assurance of proper performance is established.

In the case of gas-fired boilers and furnaces, the American Gas Association gives correction factors for changes in altitude conditions; however the details, as far as burner orifices, stacks, vents, and chimneys are concerned, are left up to the engineer or contractor. Here especially AGA requirements must be followed without deviation to be sure that no safety factors are ignored.

The importance of providing sufficient combustion air for all gas, oil, and coal-fired installations cannot be over-emphasized. In too many cases this has not been accomplished even at normal altitudes, but as atmospheric pressure decreases at higher levels, the problem becomes even more severe.

Air Cooling Is Special Problem

Much needs to be investigated about the performance of air cooled condensers at higher altitudes, especially. Some theoretical observations indicate that, assuming constant conditions at the evaporator, an ambient air temperature of 100 F, and a condensing temperature of 120 F, the performance of the system at 5000 ft altitude will not differ appreciably from performance at sea level. When the condensing temperature is increased from 120 to 130 F, however, the electrical cost for operating the compressor motor will be about 18 percent higher.

When the condensing temperature is increased to 140 F, the electrical cost will be about 36 percent higher. Therefore it was concluded that the plans and specifications should state clearly the condensing temperature desired, as well as the size of the system.

Elevations Help Cooling Towers

In the case of cooling towers, it was pointed out that higher elevations produce a gain in performance because the driving force is the enthalpy of the air. For instance, at 5000 ft, the air will have an enthalpy 16 percent higher than at sea level. The fan will handle 20 percent less mass flow because of the higher elevation.

Because the fan speed can be increased, a net gain will result. However, it was noted that this phenomenon does not apply in the case of evaporative condensers, for which performance at higher levels will about equal performance at sea level.

It was also observed that more correlation and coordination of all the factors are needed on this subject of air conditioning equipment performance at higher altitudes. Such investigation should include the rating of fan-coil units, motors, cooling coils, and all other components.

When a question was raised about the solar effect at higher altitudes, it was pointed out that experience indicates solar heat gain is about 17 to 20 percent greater for a 5000 ft elevation than for a sea level location. ≠

How Underground Reservoirs Provide Cool Water for Industrial Uses

Field Tests Determine Potential Quantity, Quality of Ground Water Supply

By JOHN F. HOFFMAN
Director of Research and Development
Griffin Wellpoint Corp.

Underground reservoirs from which water is easily obtainable, called "aquifers" may underlie many proposed industrial sites. Depending upon the hydraulic characteristics of the reservoir, which include permeability of the rock composition, the water storage coefficient, and the aquifer transmissibility, the use of ground water for process and cooling applications may be more or less practical. These characteristics are better determined in the field than in the laboratory.

This article, the third of a series, describes the methods, equipment, and computations used in field investigation of the available ground water supply

THE ground water reservoir, composed of rock which is both unconsolidated (silt and sand) and consolidated (as in popular usage) can be divided into *aquifers* (zones which yield water readily) and aquicludes, or those zones from which water is more difficult to obtain.

For industrial uses, only aquifers can be considered as an economical source of ground water, and it is about these that the present discussion is presented.

Earlier articles[1] described the general character of the ground water reservoirs, and detailed the various laboratory means available to an investigation of the prospective quantity and quality of the water available at a particular site. Such laboratory methods included grain size analysis and laboratory permeameters.

Now let us proceed to the various field tests which can be employed in determining the coefficient of permeability of an aquifer. Permeability is one of the three principal parts of a broader trait known as the *hydraulic characteristics* of an aquifer. The remaining two are the storage coefficient and transmissibility, to be discussed later.

When the permeability of an aquifer has been thoroughly investigated, the resulting information, together with other knowledge, will yield answers to important questions about the ground water capacity of a site, including the effect of pumping wells, the possibility of contamination, maximum capacity, and the selection of proper equipment.

Field Methods for Determining Permeability

Field methods for determining the permeability of an aquifer have an advantage over laboratory methods in that the aquifer itself is essentially undisturbed. Like laboratory methods, however, field methods examine relatively small portions of the aquifer, although the volume tested is much greater.

Three field methods are commonly used: tracers, field permeameters, and aquifer performance tests. Although the first two are more economical means, they are necessarily limited in scope because of the volume of aquifer actually tested. Moreover, information on boundary conditions, which we shall discuss later, must be obtained from an examination of soil samples and the use of geologic and/or topographic maps. Aquifer performance tests do not suffer these shortcomings, and therefore offer a more complete approach.

Ground Water Tracers

When tracers are used, a slug of water containing a positively identifiable compound is "traced" in order to determine the velocity of the water through the aquifer. Since the concentration of the tracer compound is very slight, there is no alteration in the density or viscosity of the water. Various devices to

[1] *How Underground Reservoirs Provide Cool Water for Industrial Uses*, Heating, Piping & Air Conditioning, October, 1960, and *The Hydraulics of Aquifers, Ibid*, May, 1961

detect the arrival of the tracer at the observation point are used, including visual detection, differences in water conductivity or radioactivity, and chemical analysis.

Commonly used tracers include fluorescein, uranine, radioactive salts, and ammonium chloride. One part fluorescein in 1 million parts water can be detected by the naked eye.

In practice, the injection well is located at the center of a grid of observation wells spaced about 3 or 4 ft on centers. Depth to water measurements, referred to a common datum, enables contouring the water table or piezometric surface around the injection well.

With this map, both the hydraulic gradient and the direction of ground water movement can be determined. For visual identification or chemical analysis, small samples are withdrawn periodically from each observation well. For conductivity or radioactivity tests, it may be possible to lower the detecting device inside the wells.

Based upon the velocity of travel and the hydraulic gradient, the permeability, in gal per day per sq ft, can be computed from the formula

$$P = 7.5\theta v/I$$

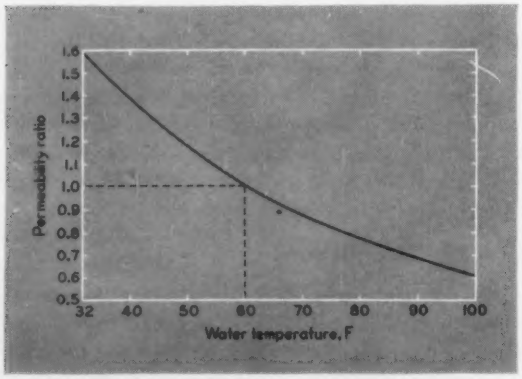
where

θ = average porosity of the aquifer, dimensionless
v = velocity of tracer travel, ft per day
I = hydraulic gradient, feet per foot

For example, if the static water level in the injection well is ½ ft higher than the water level in an observation well 100 ft away, and it takes one day to traverse the 8 ft distance between the injection well and the point of detection, the permeability of the deposits, which have an average porosity of ¼, is computed as

$$P = (7.5 \times \tfrac{1}{4} \times 8)/(0.5/100)$$
$$= 3000 \text{ gal per day per sq ft}$$

This is the permeability at the temperature of the water stored in the aquifer. To convert this permeability to standard at 60 F, the curve shown in Fig. 1 can be used.



1 VARIATION in ratio of permeability of aquifer containing water at 60 F to permeability of same aquifer with water at any temperature is shown by curve above

Field Permeameters

Field permeameters are based on the relationship between the permeability of the portion of the aquifer tested and the rate of fall of the water level in a tube, as water is discharged to the aquifer. For instance, a thin wall conduit with an inside diameter of 1 in. is driven a short distance into the soil. The pipe is cleaned out and a 4 in. cavity created below its lower edge by means of a spiral auger. This operation is continued until the lower edge of the pipe reaches a desired point below the water table.

Fine particles of disturbed soil that might clog the walls of the cavity are removed by alternately pumping down the water in the tube and allowing the level to rise. Finally, the water is pumped down to a predetermined depth below the water table, and the time to recover to a second, higher, level is observed. Then the coefficient of permeability, in gal per day per sq ft, is computed as follows:

$$P = \log_{10}(h_o/h_1)/10t_1$$

where

t_1 = elapsed time within which distance from water table to water level decreases from h_o to h_1, days
h_o = distance from water table to water level in tube at beginning of test, ft
h_1 = distance from water table to water level in tube at end of test, ft

The permeability of the soil, by virtue of the construction of the cavity, reflects largely the horizontal permeability of the zone penetrated by the cavity. Once a representative value for horizontal permeability is arrived at, the vertical permeability of the aquifer may be roughly approximated.

In fairly homogeneous sandy soils, this may be a half to a quarter of the permeability determined with this test. In sandy soils where fine sand layers are frequently interspersed with coarse sand layers, the vertical permeability may be as little as a tenth of the permeability determined with this test.

Flow to Wells

A well system is comprised of three parts: the well itself, the pump, and the discharge piping. The

well consists of an open area, through which the ground water can flow, and a cased section, which conducts the water to the surface. In rock wells, seepage takes place through the walls of the uncased hole. In granular soils, slotted metal screens or perforated casings are required to prevent the walls of the hole from sloughing.

Occasionally, wells in decayed rock or in rock containing pockets of loose soil require the use of screens for successful operation. Substitutes for well screens, such as gravel placed at the bottom of the well casing, are also used. For industrial purposes, it is poor economy to use anything except a properly sized screen.

The Effect of Pumping from Wells

Pumping a well removes water from that portion of the aquifer immediately adjacent to the screen. Water moves instantaneously from regions still further out to fill the void. The friction of the movement of water particles against the soil structure of the aquifer produces a loss in head, and a depression in the water table or piezometric surface around the well (termed the cone of depression) is created by this action.

The cone of depression expands until sufficient recharge is captured to replenish the quantity being pumped. The cone then reaches equilibrium. Sources of recharge are percolation of precipitation, leakage from overlying or underlying aquifers, infiltration from surface water bodies, and artificial recharge through wells or basins.

Shape of Depression Varies

Where a well only penetrates an aquifer partially, the cone of depression has a different shape than if the well is fully penetrating. A particle of water stored above or below the screen horizon must travel vertically as well as horizontally to reach the screen. At distances away from the well equal to twice the aquifer thickness, the effects of partial pentration are markedly reduced.

Aquifer Performance Tests

Aquifer performance tests usually give the most satisfactory results for problems concerning industrial ground water supplies. Properly conducted, this type of test yields the hydraulic characteristics and a knowledge of any influencing boundary conditions on the portion of the aquifer within the cone of depression.

Modified slightly, this test can also give information concerning the screen and the deposits immediately outside of the screen.

There are two types of aquifer performance tests — equilibrium and non-equilibrium. In the former, the cone of depression must reach a steady-state condition for the working formula to be derived. In the latter type of test, the fact that the cone of depression has not stabilized is taken into account in formula derivation, and does not influence the results.

Aquifer performance tests based on equalibrium conditions and adapted to field observations were first published by Adolph Thiem in 1906.

Here is the basic equilibrium formula for artesian conditions:

$$P = (528Q)(\log_{10})(r_2/r_1)/m(s_1 - s_2)$$

and the basic equilibrium formula for water table conditions:

$$P = (1055Q)(\log_{10})(r_2/r_1)/h_2^2 - h_1^2$$

where

P = coefficient of permeability, gal per day per sq ft
Q = rate at which well is pumped, gpm

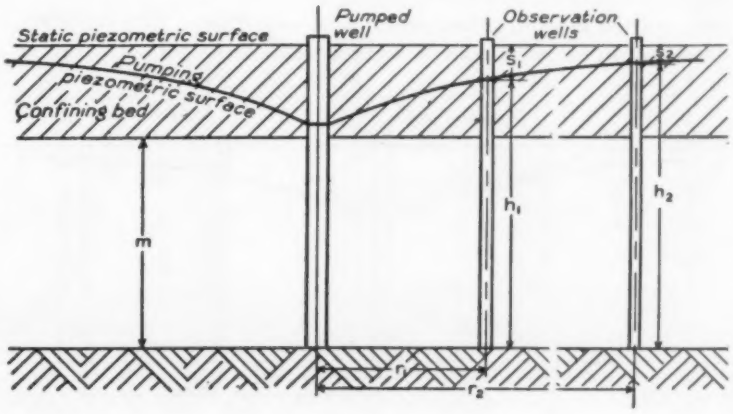
A profile of the cone of depression for each condition, and a graphic definition of the terms r, s, and h, (expressed in ft) are shown in Figs. 2 and 3.

In the above formulations, we assume:

1) the aquifer is homogeneous, isotropic, and of infinite extent

2) pumping has continued at a uniform rate for a time sufficient for equilibrium to be reached

3) the discharge well penetrates and receives water from the entire thickness of the aquifer



2 DEPRESSION in water table or piezometric surface (termed cone of depression) created by pumping from well screened in confined aquifer

GROUND WATER FOR INDUSTRY

4) the aquifer is underlain by an impermeable layer

5) flow to the well takes place radially, and

6) flow takes place under laminar conditions.

Example Shows Method

Determination of aquifer permeability with this formula is relatively simple. For instance, a fully penetrating well, screened in an artesian aquifer composed of fine to medium sand with a saturated thickness of 100 ft is pumped at a rate of 1000 gpm. The drawdown in an observation well 50 ft away, after equilibrium conditions have been reached, is 11 ft; the drawdown in an observation well 500 ft away, 1 ft.

The permeability is computed as follows:

$$P = (528)(1000)(\log_{10} 500/50) / 100(11 - 1)$$
$$= 528 \text{ gal per day per sq ft}$$

Many times it is not possible to pump a well until equilibrium conditions are established. Moreover, it may be necessary to predict the influence of pumping a well for a condition other than equilibrium. These two shortcomings of the Thiem method are overcome by the non-equilibrium method.

Uses Heat Transfer Analogy

The non-equilibrium approach, first published in 1935 by C. V. Thies, is based on an analogy between the transfer of heat, as described by the Biot-Fourier law, and the flow of ground water to a well. The drawdown in the water level in an observation well within the cone of influence at any time, t, after pumping is started is given by this relationship:

$$s = [114.6\ Q\ /\ T]\ W(u)$$

where

s = drawdown in observation well, ft
Q = rate at which well is pumped, gpm
T = coefficient of transmissibility, gal per day per ft
$W(u)$ = well function of (u)

The well function, W(u) is given by the following infinite seres:

$$W(u) = -0.577216 - \log_e u + u - u^2/2.2! + u^3/3.3! - u^4/4.4!$$

where

$u = 1.87r^2S/Tt$
r = distance of observation well to pumped well, ft
S = coefficient of storage dimensionless
t = time since start of pumping, days
with other symbols as previously defined.

Values for the well function, $W(u)$, for various values of (u) have been gathered in a Table too lengthy to reproduce here. The Table is, however, available on request to the editors.

The assumptions involved in the Thies approach are much the same as for the Thiem equation, with the exception that an equilibrium condition is unnecessary.

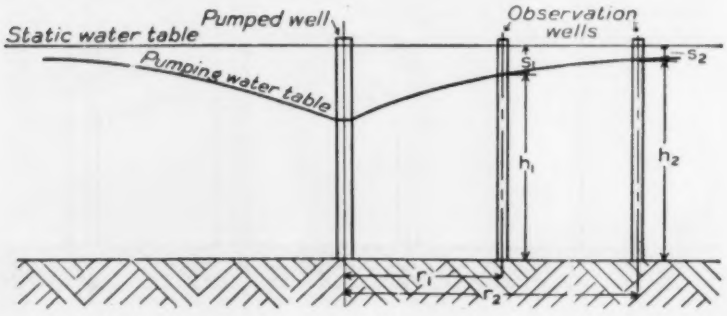
Two Means to Application

There are two approaches in the application of the non-equilibrium method — a rigorous method and a simplified method. The rigorous method involves solution of the above equations by comparison of a log-log plot of the "type curve" [(u) *vs* $W(u)$] with a log-log plot of the "observed data" [(r^2/t) *vs* (s)]. The type curve is plotted with (u) as the abscissa and $W(u)$ as the ordinate.

Matching of these plots is accomplished by superimposing the plot of the test values on the plot of the type curve, keeping the axes of both parallel. A convenient point is selected on the matched portion of the curves and both plots are marked. From the type curve (u) and $W(u)$ for the selected point are obtained. From the observed data plot, the corresponding (s) and (r^2/t) are obtained.

Transmissibility, T, is computed by substitition in this formula:

$$T = 114.6QW(u)/s$$



3 WATER TABLE depression created by pumping a well screened in unconfined acquifer

With T determined, substitution in the formula

$$S = uTt/1.87r^2$$

enables computation of the storage coefficient, S.

Fortunately, this somewhat lengthy procedure can usually be simplified. When the time of pumping, t, is large, (u) becomes very small and the previous expression for T becomes simply

$$T = 264Q\,[(\log_{10}t_2 - \log_{10}t_1) / (s_2 - s_1)]$$

This formula is further simplified to

$$T = 264Q/\Delta s$$

where

Δs = drawdown per log cycle of time
= $(s_2 - s_1) / (\log_{10}t_2 - \log_{10}t_1)$

Depth to water measurements in an observation well during pumping are converted to drawdowns by subtracting the measured water level from the static water level determined prior to pumping. These drawdowns, together with the elapsed time of occurrence, are plotted on semi-logarithmic paper. The drawdown is the arithmetic coordinate, and the corresponding elapsed time is the logarithmic coordinate.

The drawdown in one cycle of elapsed time (period from 100 to 1000 minutes) is graphically determined, as shown in Fig. 4, and inserted in the above formula.

For example, a fully penetrating well, screened in an unconfined aquifer composed of medium to coarse sand, with a saturated thickness of 100 ft, is pumped at 1000 gpm for 10 days. The drawdown in the water level in an observation well 200 ft away at various times after the start of pumping is as follows:

Time after start, days	Drawdown, ft
0.1	0.43
0.5	1.20
1	1.59
2	1.96
3	2.17
4	2.35
5	2.48
6	2.58
7	2.68
8	2.75
9	2.81
10	2.89

Plotting these data on semi-logarithmic paper in Fig. 4, the drawdown per log cycle for the straight portion of the curve is 1.39 ft. Transmissibility is

$$T = (264)(1000) / 1.39$$
= 190,000 gal per day per ft

As the thickness of saturated aquifer (m) in the region of the test is 100 ft, permeability equals

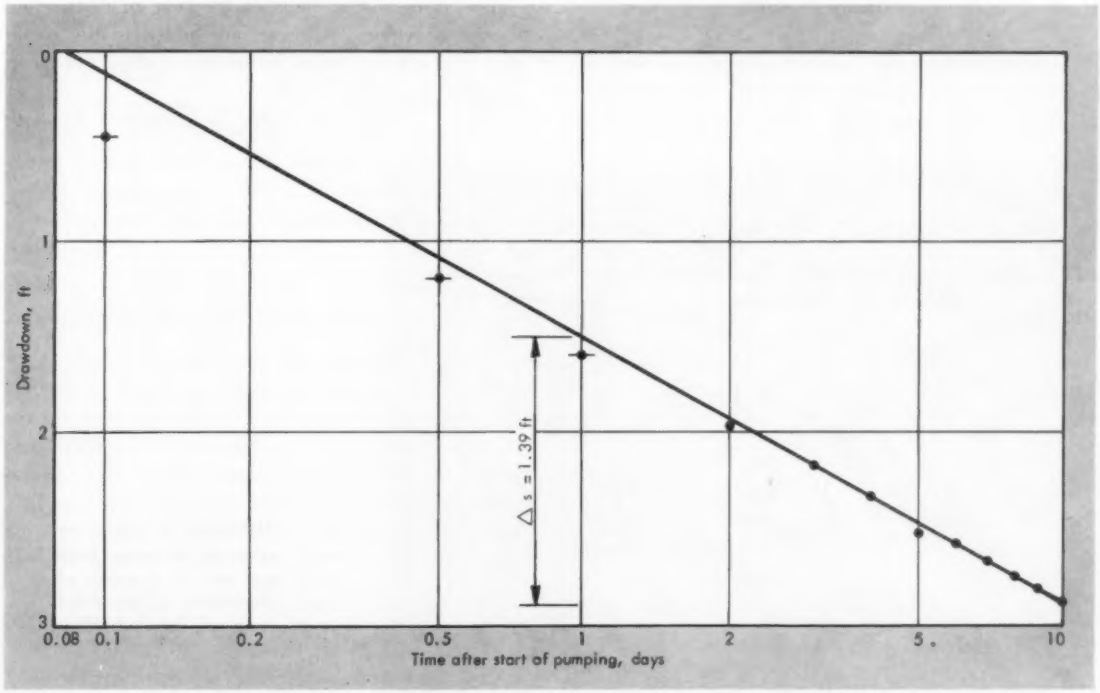
$$P = T/m = 190{,}000/100$$
= 1900 gal per day per sq ft

The specific yield or storage coefficient can also be determined from the same semi-logarithmic plot. The straight line portion of the curve is projected backward until the line of zero drawdown is reached. The time intercepted at zero drawdown is noted, and substitution made in the formula

$$S = 0.3Tt_o / r^2$$

where

t_o = time corresponding to zero drawdown
with other symbols as previously defined.



4 DRAWDOWN of water level during pumping per elapsed time period is plotted on semi-logarithmic paper for computing drawdown per log cycle and transmissibility

The storage coefficient for the example above is computed as

$$S = 0.3(190{,}000)(0.083)/(200)^2$$
$$= 0.12$$

where

t_o = 0.083 days, from Fig. 4

How Data Is Used

Once determined, the hydraulic characteristics of an aquifer can be used in a number of ways. Considering the same aquifer as above, and using the results of the aquifer performance test from the above analysis, the drawdown at a point 500 ft from the pumped well, 100 days after pumping the well at 2000 gpm is determined as follows:

From the above formula, (u) becomes

$$(u) = (1.87)(500)^2(0.12) \;/\; (190{,}000)(100)$$
$$= 0.00296, \text{ or } 0.003$$

The well function, $W(u)$, corresponding to a (u) of 3.0×10^{-3} is 5.23. The corresponding drawdown, s, is

$$s = 114.6(2000)(5.23) \;/\; 190{,}000$$
$$= 6.3 \text{ ft}$$

Aquifer performance tests require a good deal of coordination and planning to keep the costs and time involved within reasonable limits. In all cases, the results obtained are not always as clear cut as in the examples given here. Despite this, aquifer performance tests present an excellent basis for well system design.

Multiple Wells Affect Drawdown

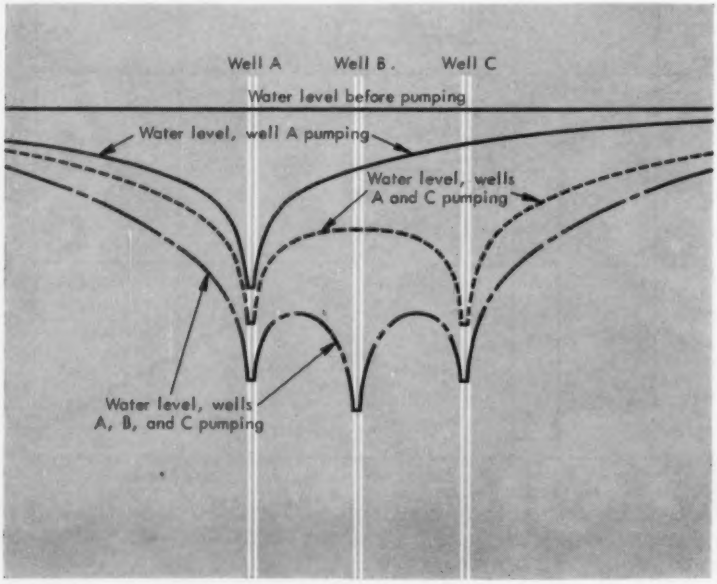
Up to this point we have considered the effect on the water table of pumping a single well. When more than one well in a group is pumped, the cones of depression overlap, and a composite effect results. Such a condition is shown in Fig. 5. Here, the depressions in the water table created by pumping one, two, and three wells are contrasted.

The drawdown at any point is the sum of the individual drawdowns. For example, considering three wells screened in the aquifer discussed above, each pumped at a rate of 2000 gpm, the composite drawdown at a common point 500 ft from each well at the end of 100 days of pumping is 3×6.3 ft $= 18.9$ ft.

Recharge Reverses Effect

Darcy's Law, which relates the velocity of water through an aquifer, the permeability of the aquifer, and the hydraulic characteristics, can also be applied to the flow of ground water *away* from a well that is recharging water to an aquifer. Where this situation occurs, a cone of recharge is formed about the well. Computation of the resultant buildup of the water table is approached in the same manner as is the computation of the shape of the cone of depression. Computed values, however, are *added* to the elevation of the water table, rather than subtracted as in the case of a pumped well.

Where the water table is influenced by both


Well A
Well B
Well C
Water level before pumping
Water level, well A pumping
Water level, wells A and C pumping
Water level, wells A, B, and C pumping

5 COMPOSITE EFFECT on water table of pumping from more than one of a group of wells. Drawdown at any point is the sum of the individual drawdowns

pumped wells and recharging wells, the net effect at any point is obtained by adding algebraically the drawdown values and the buildup values computed for the individual wells.

Streams, Barriers Affect Flow

Where a stream is hydraulically interconnected with an aquifer, or where an impermeable barrier to ground water flow exists, the quality and quantity of ground water flow to a well may be affected accordingly. The cone of depression around a pumped well is unaffected by a boundary until the boundary is reached. After that, as seen in Figs. 6 and 7, the boundary affects the shape of the cone.

The effect of boundaries on the flow of ground water through an aquifer may be determined by replacing the boundary with either recharging or discharging wells, and by using the methods of computation described above. A stream is replaced with a recharge well; an impermeable barrier with a pumped well.

These "image" wells, are shown schematically in Figs. 6 and 7. The image well is located on a line drawn perpendicular from the pumping well to the boundary, but an equal distance on the opposite side of the boundary.

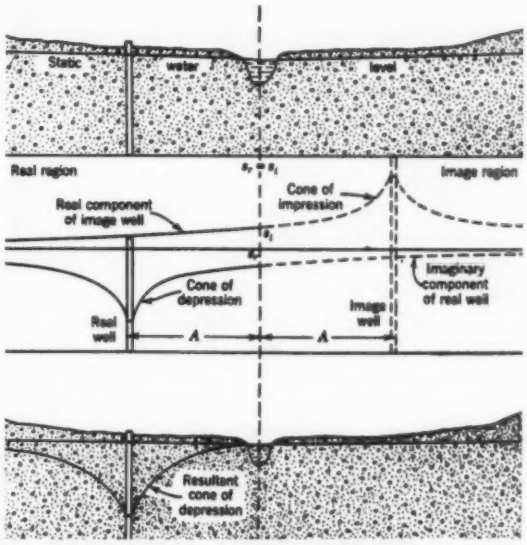
Stream Connection Varies

For streams, the boundary line may or may not be at the shoreline, for it is possible that the accumulated silt and muck form a protective covering. A channel through this material mid-stream may be the source of the leakage. On the other hand, the bottom of the river may be sandy, and seepage to the aquifer may be uniformly distributed. Similarly, rock boundaries may or may not be easily discernible. The next in this series of articles will discuss the method of incorporating boundary conditions into well system design.

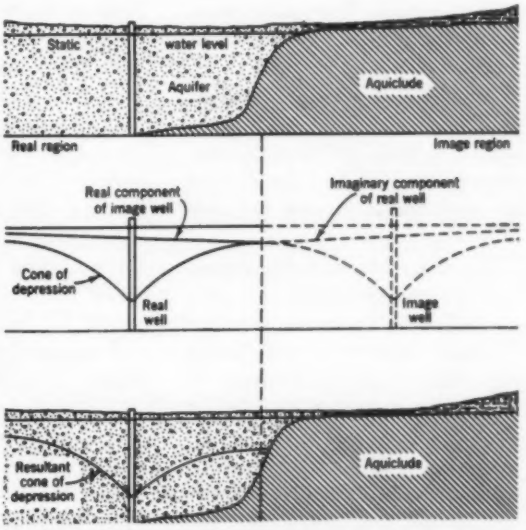
Extended Testing May Be Needed

Sometimes the nature of the problem involved in aquifer development requires more information than can be obtained from one or two aquifer performance tests. This will be true when extremely large quantities of water are needed, when serious contamination problems are present, or when water is otherwise difficult to obtain. In some states the ground water reservoir is closed to further development and additional well water supplies must be obtained by reclamatory measures.

In such cases, a regional analysis must be made. This will involve an intensive and extensive examination of the hydrology and geology of the area, utilizing data such as streamflow records, inventories of



6 DRAWDOWN in water table resulting from pumping a well near stream that is hydraulically connected to an acquifer



7 DRAWDOWN in water table resulting from pumping well near an impermeable boundary

wells drilled in the area, and of ground water withdrawals, results of a number of aquifer performance tests, geochemistry, and so forth.

Careful piecing together of such facts will form the picture of the geohydrology of the area, and once formed, this picture will allow a more logical view of reservoir development. ⫩

The next article will discuss the well itself — the second part of aquifer hydraulics — including the well system design, well drilling and development, and well acceptance tests. Succeeding articles will cover pumps and pumping equipment, the chemistry of ground water and corrosion, and ground water problems.

the law and your profits

JOHN F. MORRISSEY, author of this regular feature, is an attorney at law and has an extensive practical business and legal background. This series is based on actual cases. All names are, however, fictitious. It should, of course, be remembered that the law varies in different states.

"Low Bid" Principle for Public Works May Not Be As Simple As It Sounds

IN MANY instances the law, as well as the policy of various governing bodies, requires that public work and construction contracts be awarded to the lowest bidder.

Although the principle is simple and the economic benefit to be served is well understood, many court battles have been fought over the application of such principle or laws.

The state statutes in the following case required cities and other municipalities to award any construction contract to the "lowest responsible bidder." Desirous to build a new city hall, the City of Frugality published a notice and invitation to all interested contractors to submit, in accordance with certain specified instructions and proposal forms, bids for the enumerated branches of work involved. Among the branches listed in the notice were heating and air conditioning.

Specific instructions as to bids were supplied by the city's architects. Among other things, the instructions required that the proposals be separate with respect to each branch of work.

When the bids were opened, the low bid for air conditioning was found to be $53,165 submitted by Versitil Bros. For heating, the low bid was submitted by Singular Heating Co. in the amount of $57,500. However, among the proposal forms was a letter from Versitil Bros. offering to complete both the heating and air conditioning for $109,100.

When the City of Frugality showed an intent to accept such a combined bid from Versitil Bros., Singular Heating Co. brought a court action to force rejection of the combined bid of Versitil and asked that the city be made to accept the bids according to law.

The lawyer for Singular Heating argued that the combination bid was not authorized nor contemplated in the terms of the bidding, that it was not made on the proper proposal form, and that it had the effect of depriving the people of the benefit of competitive bidding because each bid was not considered under the same conditions.

The trial court agreed with Singular and ordered the city to reject the combined bid. The city then invited new bids to be submitted for the air conditioning and heating on a separate and/or combined basis. But Versitil Bros. appealed the ruling to a higher court.

On appeal, Versitil's attorneys argued that the law was substantially complied with and that the city was not hurt by the submission of the combination bid, but on the contrary, stood to benefit by having the work completed at a lower price than it would have otherwise. "The primary purpose of the law is to have work awarded to the lowest bidder," said Versitil, "and we were the lowest bidder."

"But," said the court, "the bidding instructions did not authorize the alternative of combination bids. There is no telling how many other and lower bids there might have been if other contractors had understood that combination bidding was authorized.

"There must be a common standard by which to measure all bids, for without it there is not present the necessary element of equal opportunity to bid on the same basis which is implied in the statutory requirement of letting the work to the lowest responsible bidder.

"To have awarded the contract to Versitil Bros. on the basis of their combination bid when all other bidders submitted separate bids as required by instructions would have been an act of favoritism which the statute was enacted to prevent."

So after a long and costly court battle, the bidding began all over again. ⊣

Nomograph Gives Weight of Flow Through Nozzles For Dry Saturated Steam

By SYLVESTER SALVA
Engineer

THE WEIGHT of dry saturated steam which will be discharged through a given nozzle during a given period will vary only in accordance with changes in the initial absolute steam pressure, P_1, so long as the pressure against which the nozzle discharges does not exceed 58 percent of the initial steam pressure.

For example, if steam at an initial pressure, P_1, of 100 psia is discharged from a nozzle, the weight of the steam flowing in a given time will remain practically constant for all values of pressure against which the steam is discharged (P_2) which are equal to or less than 58 psia.

If, however, the final pressure is more than 0.58 of the initial steam pressure, the weight of the steam discharged will decrease, nearly in proportion to the reduction in difference between the initial and final pressures.

A satisfactory formula for the "constant flow" condition (when the final pressure equals 0.58 of the initial pressure or less) is

$$F = A_o P_1^{0.97}/60$$

where

F = flow of steam (initially dry and saturated), lb per second

A_o = area of the smallest section of the nozzle throat, sq in.

P_1 = initial absolute steam pressure, psia[1]

The nomograph on the following page affords a direct reading of the weight of steam flow when final pressure is equal to or less than 0.58 initial steam pressure, given the area of the throat nozzle and initial pressure.

Example 1

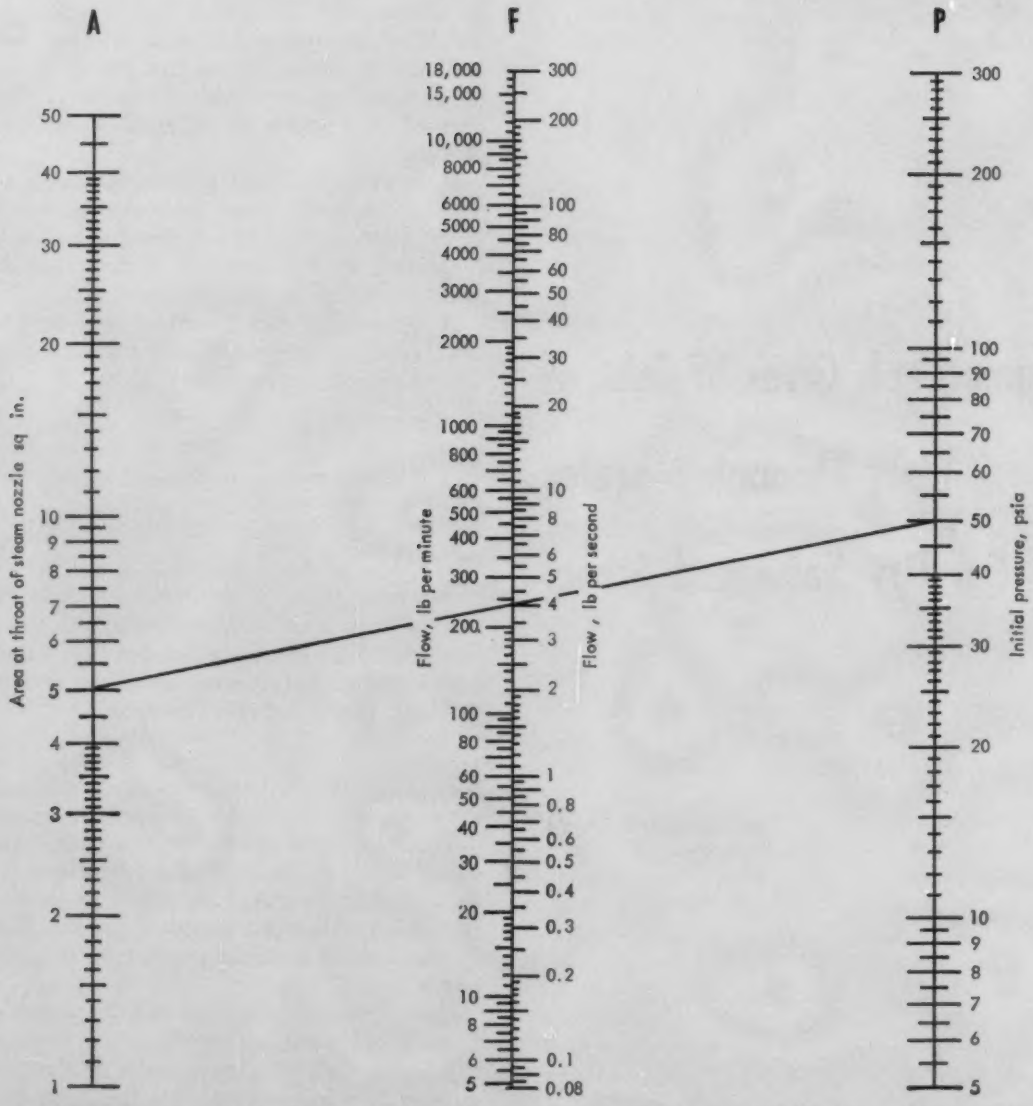
The area, A_o, at the throat of a suitably designed nozzle is 5 sq in. Find the weight of the flow, F, of dry saturated steam in lb per second from this nozzle when the initial pressure P_1 is 50 psia and the discharge pressure P_2 equals 14 psia.

Here P_2 equals less than $0.58P_1$; thus the formula and nomograph apply.

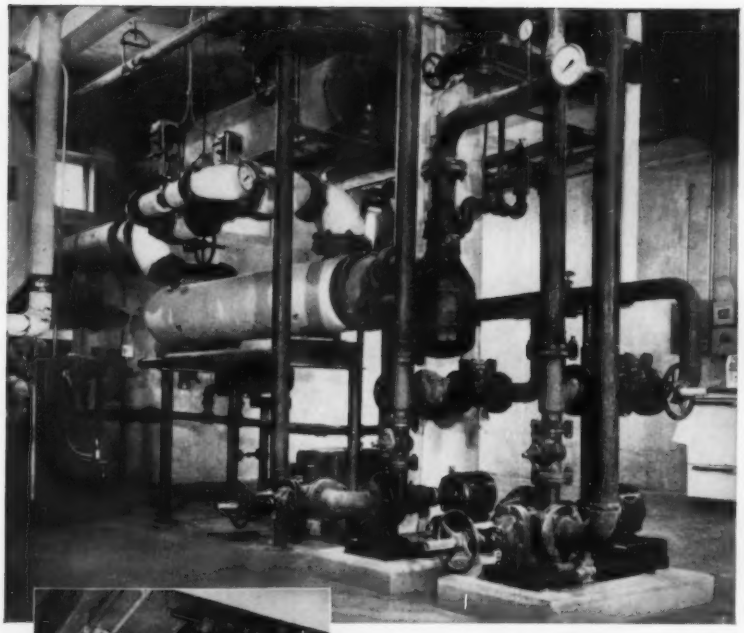
Solution: Enter the nomograph on the area scale at 5 sq in., and extend a line from that point to the 50 psia value on the initial pressure scale. At the intersection of this line with the center scale, read steam flow as 4 lb per second.

The calculated value for this example is 4.021 lb per second. However, the value obtained from the nomograph is accurate enough for most requirements. ∓

[1]Grashof, *Theoretische Machinenlehre*, Vol 1, p. iii; *Hutte Taschenbuch*, Vol 1, p. 333. Grashof states the formula as $F = 0.01654A_oP_1$



NOMOGRAPH provides for direct reading in lb per second or lb per minute of weight of steam flow through nozzle of known area when initial pressure is known — for all conditions when final pressure equals 58 percent of initial pressure, or less



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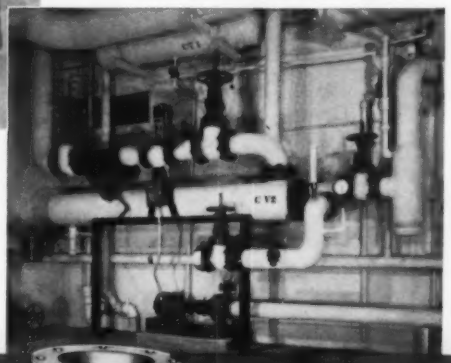

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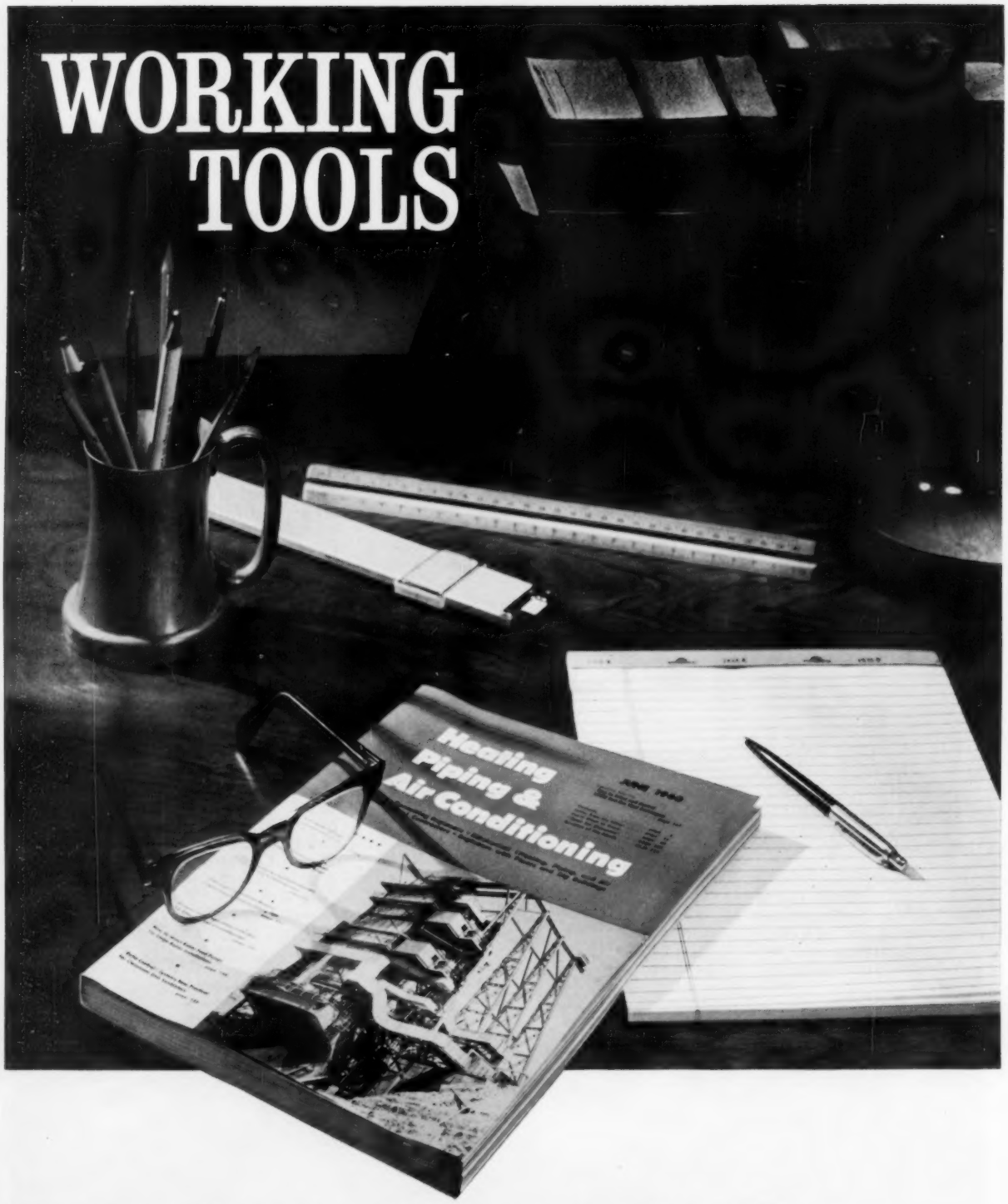

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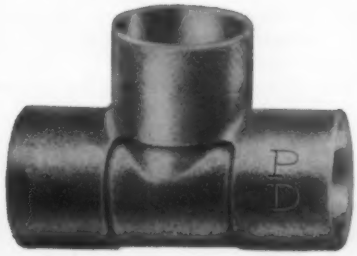

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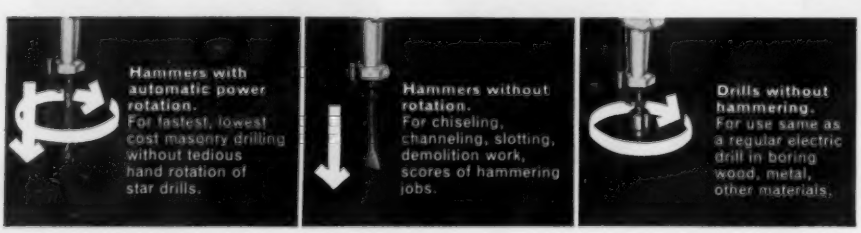
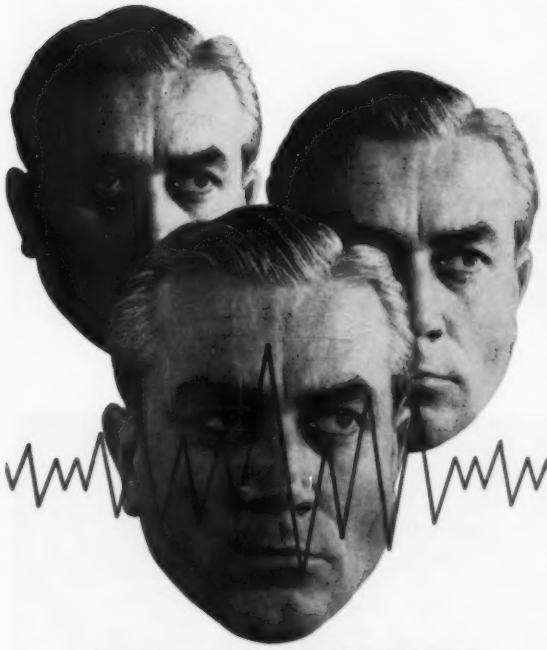

Hammers with automatic power rotation. For fastest, lowest cost masonry drilling without tedious hand rotation of star drills.
Hammers without rotation. For chiseling, channeling, slotting, demolition work, scores of hammering jobs.
Drills without hammering. For use same as a regular electric drill in boring wood, metal, other materials.

...and only Skil Roto-Hammers use 4 types of percussion-rotary bits...over 150 accessories in all for unequalled versatility!



WHERE NOISE IS A NUISANCE SPECIFY RAY BOILERS

INSULATED FOR QUIET OPERATION

Noise is a problem of great importance in such locations as schools, hospitals, research laboratories, churches, office buildings and theaters. To help combat this problem, Ray engineers have paid particular attention to the reduction of operating noise in Ray Packaged Boilers.

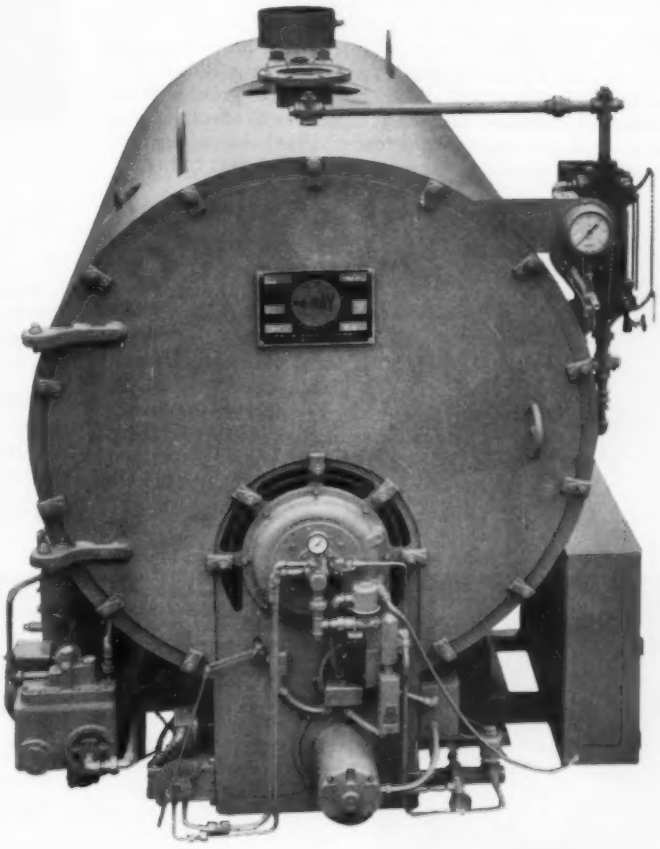
To effectively silence the sound of rushing combustion air and fan noises, the air is drawn through a specially designed labyrinth of acoustically treated sound-absorbing passages within the windbox. Other Ray low noise features include heavy, vibration-free construction, quiet, low horsepower motors, and large, dynamically and statically balanced fans. In dual gas-oil units, the compressor motor is automatically switched off during gas operation. Ray Boilers provide finger switch selection of gas or oil firing, and require a minimum of supervision, due to electronically controlled, fully automatic operation.

From the world's first horizontal rotary oil burner, introduced by Ray, to the latest in Packaged Boiler systems, Ray's 89 years of experience guarantees you the most reliable products available in the field of combustion equipment.

Ray Packaged Boilers are sold and serviced by one of the most complete dealer organizations in the world. You'll find your Ray Dealer in the Yellow Pages of your 'phone book.

CHOSEN FOR RELIABLE, AUTOMATIC OPERATION...

This 60 h.p. Series E Ray Packaged Boiler (see illustration) is being installed in the Farm Dryer Experimental Laboratory, Agriculture Division, Oregon State University, Corvallis, Oregon.



LEADERS IN THE FIELD OF COMBUSTION EQUIPMENT SINCE 1872

THE BOILER WITH AN INTERNATIONAL REPUTATION

RAY

RAY BURNER CO.
BOILER DIVISION
1301 SAN JOSE AVENUE
SAN FRANCISCO, CALIFORNIA
4024 FILBERT STREET
PHILADELPHIA 4, PENNSYLVANIA

How to gain effective insulation

Insulate and Protect Hot or Cold Underground Piping in One Operation

By GENE HOPPE,
Product Manager,
Witco Chemical Company, Inc.
Pioneer Products Division

Are you troubled by the problems involved in installing permanent underground hot and cold piping?—by the complexity of operations required to insulate, protect against corrosion and electrolysis and ward off water infiltration?—or by cracked concrete allowing exposure to ground chemicals and moisture? Here is your answer to effective insulation and protection. Now a material has been created that handles all these problems at one stroke—WITCOLITE®

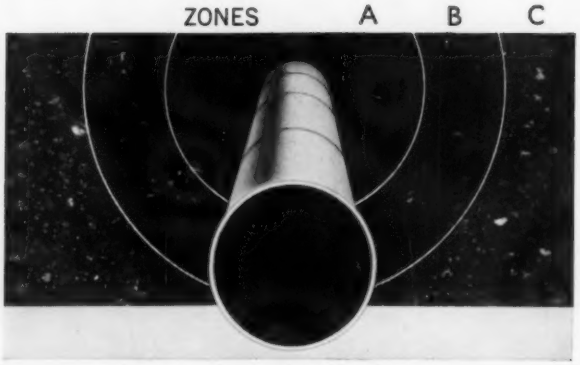
What is WITCOLITE?

WITCOLITE is a dry, granular, adhesive material, manufactured under carefully controlled conditions from resinous hydrocarbons of petroleum origin. It forms a permanent and flexible, highly effective insulating and corrosion-resisting structure around pipes when they are originally heated to recommended temperatures.

Estimated Wt of WITCOLITE

Pipe Size Inches	No. of 50-lb bags for 10 lineal ft
1 - 2	5
3 - 4	8
5 - 6	15
8	20
10	34
12	40
14	51
16	65
18	73
20	92

WITCOLITE is delivered to the job site in 50-lb bags. It is poured into a trench or form surrounding the pipe and tamped down with conventional equipment. Backfilling can be started after heat cure is completed.



How Does it Work?

As WITCOLITE is subjected to heat of piping, a 3-zone structure is formed: (A) Cured Zone—consisting of an insulating and anticorrosive area locked around pipe; (B) Sintered Zone—an air-pocketed insulating and moisture-resistant barrier; (C) Granular Zone—loose particles providing maximum thermal insulation.

Where is it Used?

WITCOLITE is used wherever hot underground piping is installed: industrial plants, refineries, public utilities, schools, institutions, municipal buildings and others. It can also be used with pipelines that alternately convey hot and cold liquids.

WITCOLITE TECHNICAL DATA

Thermal Insulation Value (K)	0.40 to 0.60 BTU per hr, per sq ft, per degree F, per inch of thickness Zone A 1.0 Zone B 0.40 Zone C 0.60	Flash Point 550°F Bulk Density 40 lbs per cu ft (Granulated) 1¼ cu ft per 50-lb bag; 50 cu ft per ton (Compressed) 45.0 lbs per cubic foot
Fusing Point	Grade A: 212° or less Grade B-1:212 to 300°F Grade B-2:300 to 360°F	Adhesion to Metal Lbs per sq in @ 77°F (Scott Tensilometer) Grade A: 255 Grade B: 275
Compression Strength Fused Zone @ 70°F (Soiltest compression tester)	Grade A: 1400 psi Grade B: 1460 psi	Steam Pressure (Gauge) 120 psi Approx Temperature Zone A 165°F Zone B 130°F Zone C 110°F
Water Absorption Total Immersion 6 wks @ 77°F	Grade A: 0.732% gain Grade B: 0.701% gain	

Complete information on properties and applications of WITCOLITE is given together with installation instructions in our Technical Service Bulletin W-22. Write today for your copy to Technical Service Dept 8105

WITCO CHEMICAL COMPANY, INC., PIONEER PRODUCTS DIVISION, 122 East 42nd St., New York 17, N.Y.

SALES OFFICES: NEW YORK • CHICAGO • LOS ANGELES • TORONTO AND MONTREAL, CANADA

PIONEER division of WITCO

EQUIPMENT DEVELOPMENTS

Compact Centrifugal Chiller Uses 18,000 Rpm Motor

Packaged centrifugal chiller available in eight size increments from 50 to 100 ton refrigeration capacity represents major advance in design permitted by 300 cycle motor operated at 18,000 rpm. As a result of higher speed, size and weight reduction achieved is one to five for compressor and motor. Completely assembled unit will pass through standard 36 in. wide doorway. Total packaged weight of 100 ton unit is 6700 lb, including frequency converter which supplies 480 v, 300 cps a-c current to motor. Uses Refrigerant No. 11 to permit relatively low pressure design features. Motor is refrigerant cooled. Centrifugal compressors now feasible for installations requiring capacities below 125 tons. Send for literature. — *American-Standard Industrial Div., Detroit* 32, *Mich.*

Gas-Oil Burners Rated Up to 4,200,000 Btu Per Hr

Two sizes of gas-oil burners available: 700,000 to 2,250,000 Btu per hr input; and 1,400,000 to 4,200,000 Btu per hr input. Used as single or dual fuel burners for any fuel gas or No. 2 fuel oil, arranged for either pedestal or suspended flange mounting. Suitable for positive or negative furnace pressures in any type of boiler or furnace. Includes an indicating program timer to sequence the blower motor, flame rectification combustion safeguard, and motorized valve or solenoid oil valves. — *Webster Engineering Div., Midland-Ross Corp.*, 1402 *S. 69th East Ave., Tulsa, Okla.*

Airborne Particle Monitor Detects Condensation Nuclei

Unit uses the "cloud chamber" method of detecting nuclei in the atmosphere. Detects particles less than four-millionths of an in. in diameter. Works by causing droplets to be formed artificially around each tiny nucleus. The nuclei then grow to microscopic size. This is large enough to cause scattering of a light beam directed into their midst. Measured electronically, the light scattering indicates the concentration of nuclei in the man-made fog. It takes five-thousandths of a sec to form a measurable cloud. Detects a variety of gases, but not the "noble" types such as helium, argon, and krypton. Continuous operation of unit permits its use for automatic monitoring of the air in a remote location. The continuous operation is achieved by forming and measuring five to eight cloud masses a sec inside the instrument's cloud chamber. Possible applications are almost unlimited, from helping to forecast weather to use in air pollution control. The device is not yet commercially available. — *General Electric Co., Schenectady* 5, *N.Y.*

INFORMATION on capacities, dimensions, applications, and special features in each **EQUIPMENT DEVELOPMENT** item is presented in accordance with material furnished by the manufacturers, who may be contacted directly for more details.

Other Departments . . .

Recent Trade Literature 182

We Hear That 192

Meetings and Conventions 197

New Books and Reports 201

RUGGED SIMPLICITY

...one of the many features of the first high-velocity induction units with built-in bypass control!

Here is a breakthrough in air conditioning of significance to all who design or install large multi-room building systems. Carrier has perfected a means of using the reliable and extremely simple air bypass principle to achieve automatic capacity control of high-velocity induction units.

With this new method, the rate of water flow through the coil remains constant. Total air quantity discharged by the unit into the room also remains constant. This approach to temperature control of induction units assures these major installation, performance and maintenance advantages:

Factory-installed and factory-calibrated controls

Fully self-contained—no external pneumatic system

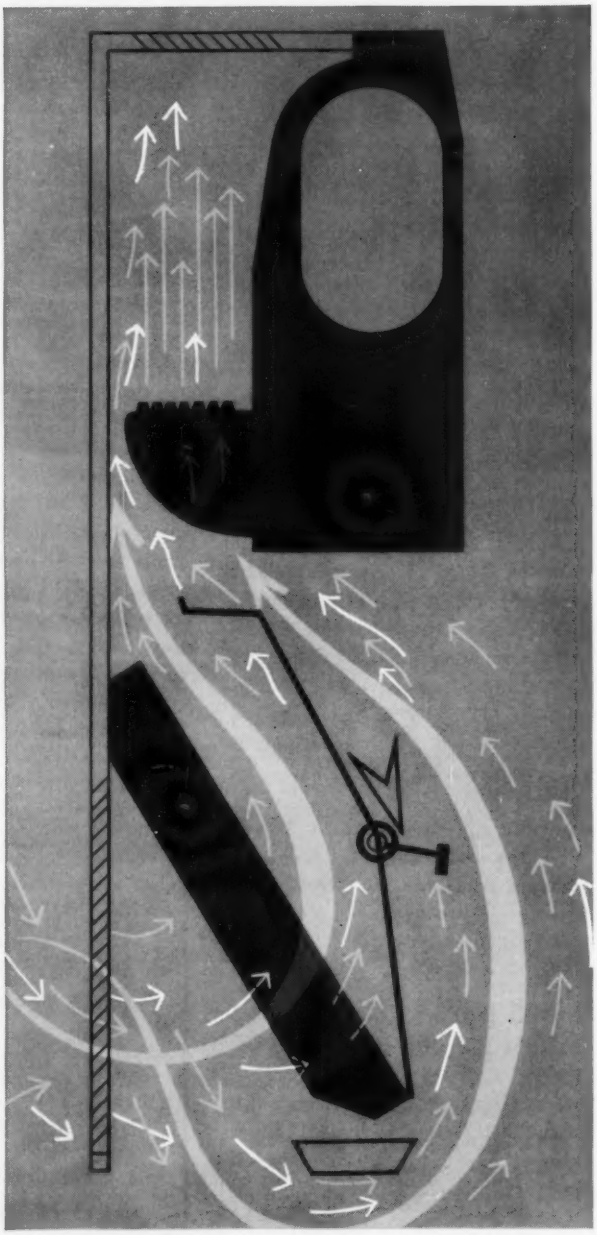
Instantaneous response to room temperature changes

Smooth and silent action—no water throttling noise

Water control valves completely eliminated

For complete information about the new 36R Bypass Weathermaster* Unit, write Carrier Air Conditioning Company, Syracuse 1, New York. In Canada: Carrier Air Conditioning Ltd., Toronto 14.

**Reg. U.S. Pat. Off.*



Bypass damper provides any coil capacity from zero up to 100 per cent. In cutaway above, damper blade is half open.

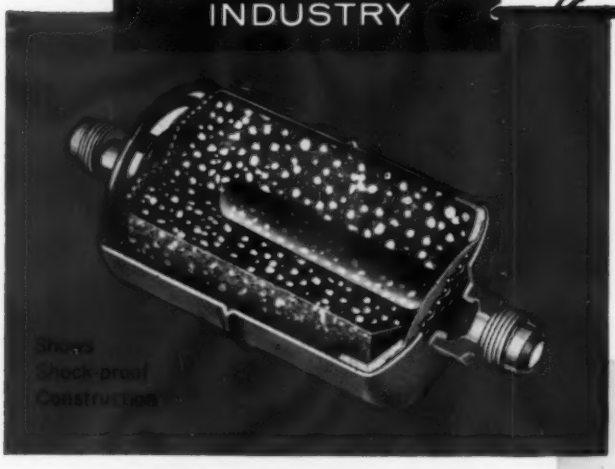
Carrier Air Conditioning Company

ALCO
offers the
FIRST and **ONLY**
Silica-Gel P.A. 400
and Molecular Sieve
BLOCK DESICCANT
FILTER-DRIER
to the
REFRIGERATION
INDUSTRY

Mr. A. D. K. says:

To Protect the System and Yourself use the

A ALCO DK
DRI-KLEANER



Important Advantages and System Benefits:

1. Exclusive Alco binder assures a block of 97% pure desiccant.
2. Manufactured by Alco's specially developed forming process (not pressure moulded)—eliminating packing effect—assuring greater uniformity of flow.
3. Geometry of ADK block exposes maximum surface to adsorb and filter out moisture and fine particles.
4. Directed and even distribution of liquid gives filtration in depth—coupled with short flow path means low pressure drop—longer system life.
5. Rigidly controlled activation—factory sealed.
6. Maximum system protection against acids and other foreign matter.
7. Copper (ODS) fittings mean easy brazing.
8. Brass (SAE) fittings means no flare nut creep.
9. Full flow fittings mean low pressure drop.

ALCO DRI-KLEANER is your insurance for a longer, more trouble-free system life.

• *BUY SECURITY*
• *BUY QUALITY*
• *BUY ALCO*

ALCO VALVE CO.
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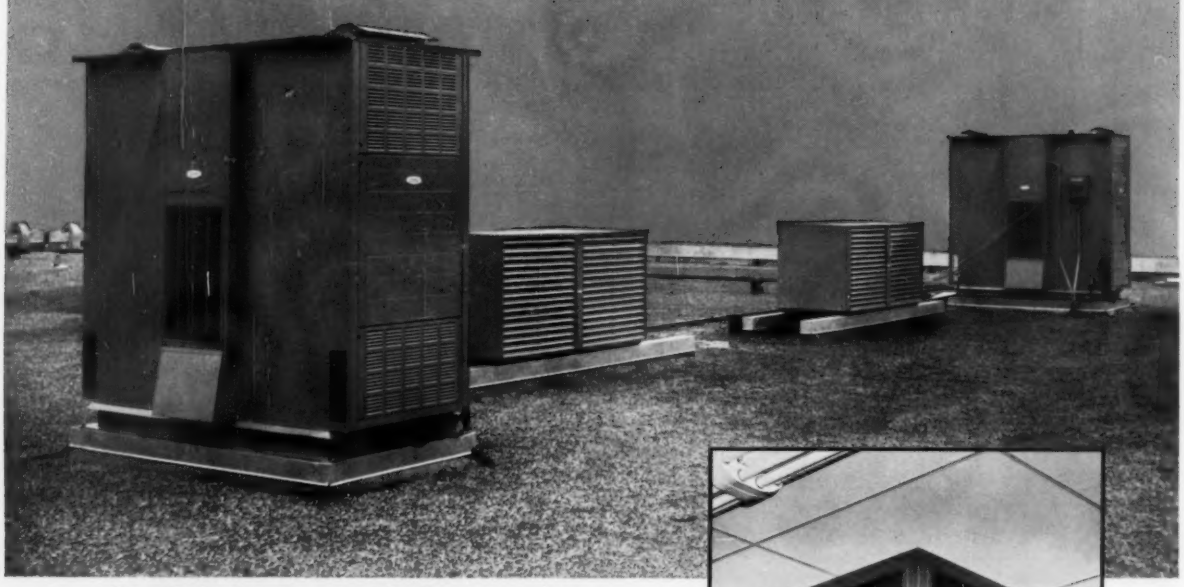
The one complete line of refrigerant controls: Thermostatic Expansion Valves • Refrigerant Distributors • Solenoid Valves Refrigerant Filter-Driers • Suction Line Regulators • Flooded Evaporator Controls and Reversing Valves

NEW LENNOX® ROOF TOP UNIT GIVES YOU UNMATCHED FLEXIBILITY...



Above: Handsome appearance on shopping center roof. Here, a condensing unit serves each roof top unit. One large condensing unit could serve both roof top units.

Right: Air outlets are 3½-in. below ceiling to minimize smear. Four way deflection grilles permit complete control of air direction and throw. Return air enters bottom grille. (Flush diffuser is optional.)

- **Spot-cool or heat wherever needed (such as check out areas).**
- **Can use directly connected ceiling diffuser (adjustable) or duct system —or combination of both.**
- **Outdoor air for ventilation and "free" cooling is automatically controlled . . . up to 100%.**
- **Ideal for zoning. One Lennox unit can serve as two independent heating-cooling units.**
- **Cooling capacity: 7½ or 11 tons each.**
- **Gas heating capacity: 102,000 to 340,000 btuh input (increments of 34,000).**

.....for HEATING! COOLING! VENTILATING!

Now, out of sight, out of mind, out of the high cost sales floor area! This new Lennox Roof Top Unit sits quietly on the roof, providing the year 'round comfort conditions required by your business. Two Lennox Landmark® (modular heating and cooling) units are expertly designed and combined into one package to give you unmatched flexibility in a roof top unit.

Duct carries warm air to "curtain" the doorway. When delivered air is cool, automatic damper diverts it back through diffuser head.

There are over 5,000 factory-trained Lennox Dealers ready to serve you. They are backed up by 200 field engineers and 22 National Account Specialists. Write for complete data offered free in detailed "Roof Top Unit" Kit. Address: Lennox Industries Inc., 542 S. 12th Avenue, Marshalltown, Iowa.

Don't be satisfied with less than

LENNOX

HEATS • COOLS • TREATS AND MOVES AIR

IN HOMES IN CHURCHES IN SCHOOLS IN BUSINESS IN INDUSTRY

LENNOX Industries Inc., est. 1895 — Marshalltown, Ia.; Columbus, O.; Syracuse, N. Y.; Decatur, Ga.; Ft. Worth, Tex.; Salt Lake City, Utah; Los Angeles, Calif. LENNOX Industries (Canada) Ltd.—Toronto, Montreal, Calgary, Vancouver, Winnipeg.

EQUIPMENT DEVELOPMENTS

Continued

Air Compressor Device Balances, Holds Receiver Pressure

Maintains receiver pressure within 1 psi of any given setting while the compressor is in operation. Increases the volumetric efficiency of the compressor by as much as 10 percent. Has only one self-actuated moving part; requires no internal adjustments, cleaning, lubrication, or other maintenance. Motor load is always in direct proportion to the air demand. Standard units for 150 psi pressures. Multi-stage compressors require a governor for each stage. Send for bulletin. —*Trymac Corp.*, 16 *W. 5th St., Erie, Pa.*

Pipe Repair Clamps Available In Wide Range of Pipe Sizes

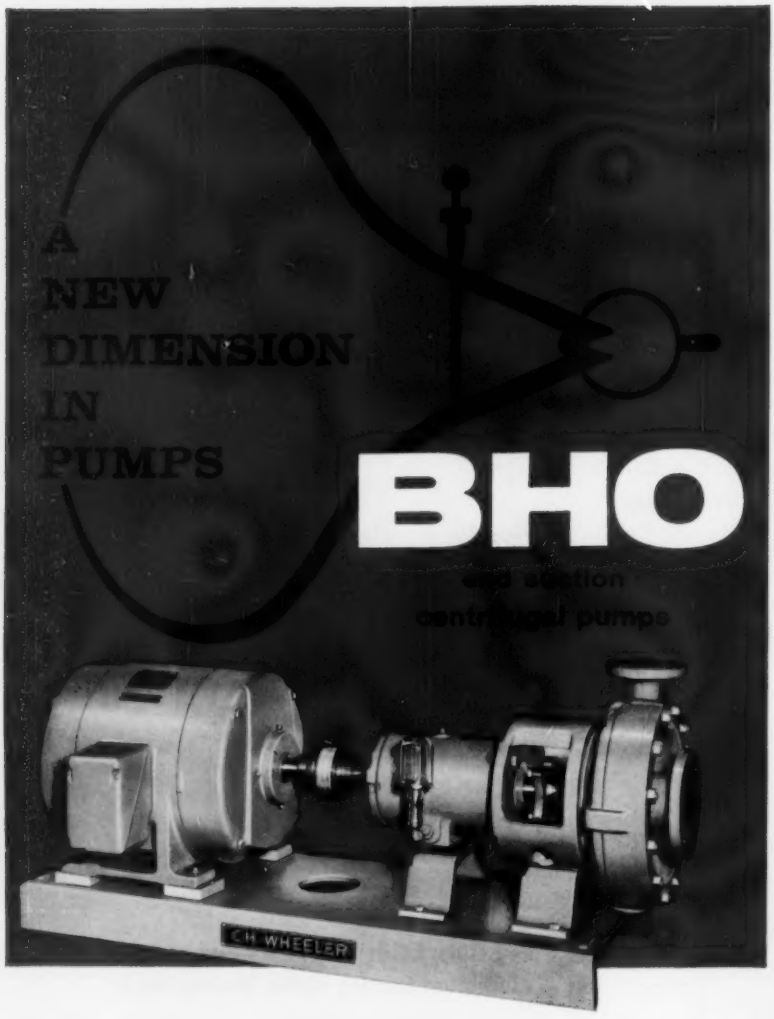
Heavy duty "Patchmaster" available from ½ to 24 in. in standard pipe sizes and from 2 through 8 in. in OD pipe sizes. Can be supplied in four clamp widths from 3 through 12 in. A stainless steel band resists corrosion and conforms to pipe contours and irregularities, but will not collapse weak pipe. Send for additional information. — *Marman Div., Aeroquip Corp.*, 11214 *Exposition Blvd., Los Angeles* 64, *Calif.*

Registers, Grilles, Diffusers Have Aluminum Frames, Nylon Moving Parts

Registers, grilles, and curved blade diffusers feature extruded, anodized aluminum frames combined with all-Nylon moving parts, blades, and damper mechanisms. Nylon has a heat resistance of over 300 F and is non-combustible. Vinyl gasket extrusion is fitted into a special channel in the undercarriage of the frame and is permanently in position. Send for catalog. — *Air Guide Corp.*, 275 *N.W. 27th St., Miami* 37, *Fla.*

Pipe Holders for Use with Hydraulic Benders

Two pipe holders for use with firm's hydraulic benders will keep pipe level and parallel with bender shoes and pipe supports throughout the bending operation. This eliminates "wows" and "dog legs." Units clamp to each end of the pipe, and fit all pipe sizes from 1¼ to 4 in. in diameter. Send for additional information. — *Greenlee Tool Co.*, 2136 *12th St., Rockford, Ill.*



Dimensioned to your requirements, this new C. H. Wheeler development is the most modern pump available for the chemical, process, heating, ventilating and air-conditioning industries.

BHO End Suction Centrifugal Pumps are offered in 350 Series (stainless steel and corrosion resistant materials) for chemical and 300 Series (cast iron alloys and bronzes) for general process services.

A complete range of 14 pump sizes from 1″ to 5″ in both series. The size and type you need to do your job. Available for immediate shipment.

Call your C. H. Wheeler representative for full details or write for 12-page catalog and pump design manual.

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Affiliated sources for heat exchangers,
steam condensers, pumps, marine auxiliary equipment,
sea water distillation plants,
nuclear steam generators and related components.

EQUIPMENT DEVELOPMENTS

Continued

Packaged Scotch Boilers Rated Up To 600 Hp Output

Available in both a wet back version producing either steam or hot water, and in a dry back design for steam processing work. Series "202" is rated up through 600 hp output. "400" series is of wet back construction and comes in two types: a low pressure model with a rated output of 50 through 100 hp for 15 psi steam or 30 psi water; and a high pressure model for 100 through 150 psig steam, with a rated output of 30 through 100 hp. All models fired by gas, oil, or gas-oil. Operating efficiency is in excess of 80 percent. Forced draft units contain 5 sq ft of heating surface per hp. Information sent on request. — *Iron Fireman Manufacturing Co., 32 W. 106th St., Cleveland 11, Ohio.*

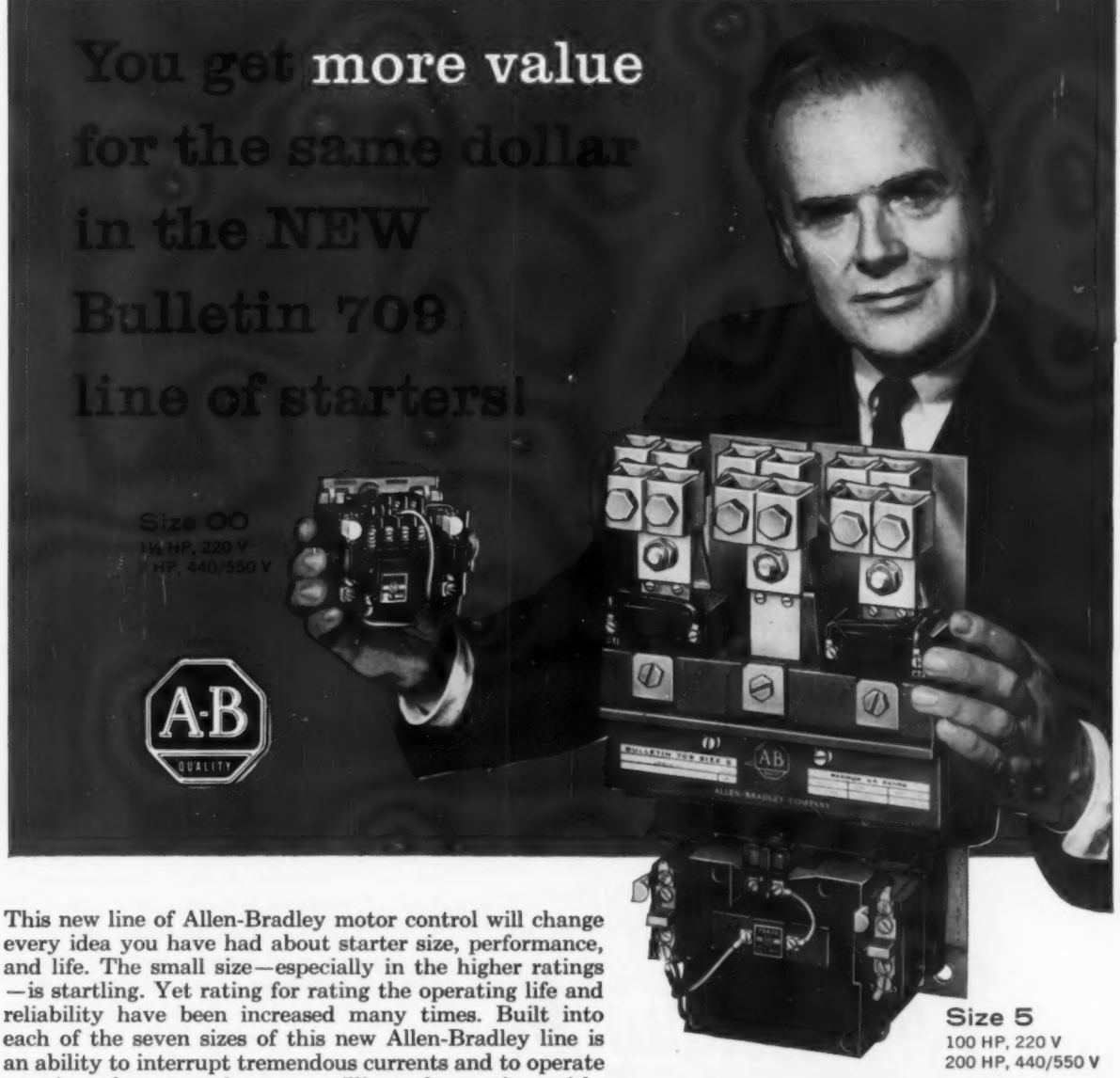
Water Treatment System for Cooling Towers, Condensers

Automatic chemical feeder and filter for correcting various water conditioning problems such as scale and corrosion. Applications include heat exchangers, evaporative condensers, cooling towers, and similar uses. Send for additional information. — *Culligan Inc., Northbrook, Ill.*

System Controls Temperature Of Superheated Steam

System regulates and controls temperature of superheated steam by desuperheating with water. Holds its settings with a single adjustment of a thermostat. System includes a desuperheater with a forged steel body, a diaphragm control valve with stainless steel trim, and a thermostat with a steel body to withstand high temperatures. Temperature ranges up to 900 F, holding such a temperature within ± 10 F. — *Atlas Valve Co., 280 South St., Newark 5, N. J.*

You get more value for the same dollar in the NEW Bulletin 709 line of starters!



Size 5
100 HP, 220 V
200 HP, 440/550 V

This new line of Allen-Bradley motor control will change every idea you have had about starter size, performance, and life. The small size—especially in the higher ratings—is startling. Yet rating for rating the operating life and reliability have been increased many times. Built into each of the seven sizes of this new Allen-Bradley line is an ability to interrupt tremendous currents and to operate year in and year out for many millions of operations without trouble or maintenance.

The new Bulletin 709 starters are just as advanced in appearance as they are in performance. All seven sizes have an aristocratic styling and a distinctive family likeness. Brooks Stevens, famous industrial designer, has given the enclosures such an attractive, modern style that these new starters will prove a distinct sales asset on any machine or installation.

Why not write today for more information on this revolutionary new line of Allen-Bradley Bulletin 709 *quality* across-the-line motor starters?

Note the compactness of both the smallest and largest starter in the new Bulletin 709 line. Ratings up to 100 hp, 220 v; 200 hp, 440-550 v.

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Member of NEMA

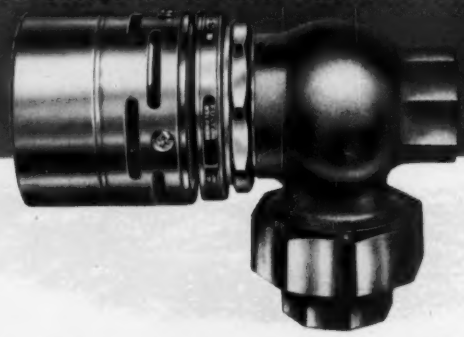
Allen-Bradley Co., 1335 S. First St., Milwaukee 4, Wis.

QUALITY MOTOR CONTROL

Lowest Cost *Individualized* Control

. . . for one office or a 400-room hotel!

ROBERTSHAW AUTOMATIC RADIATOR VALVES



No. 885 for exposed radiators

The most flexible, lowest-cost answer yet to the need for *individualized* control of new or existing heating plants!

Replace ordinary radiator valves with these Robertshaw Automatics . . . design them into your largest, most modern new installation . . . and you have perfect control combined with outstanding economy.

Actuated by sensitive Robertshaw seamless metal bellows, these precision valves are easily adjusted to individual needs . . . and can be locked to retain their setting.

- **For steam or hot water service**
- **Positive response to temperature changes**
- **Self-contained, self-operated**
- **No packing to wear out**
- **Low initial cost; no upkeep**

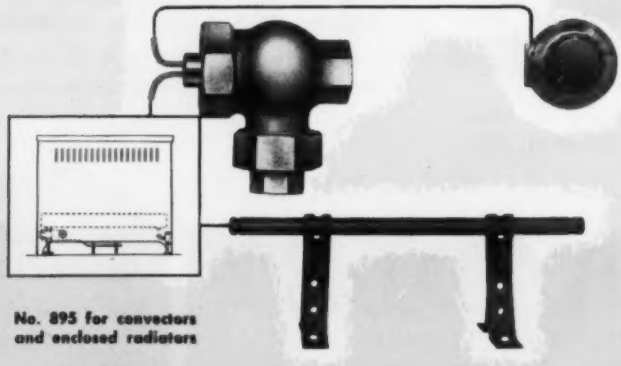
Complete Specifications in Catalog 1700.

Robertshaw

MR. CONTROLS

Robertshaw-Fulton Controls Company

FULTON SYLPHON DIVISION, KNOXVILLE 1, TENNESSEE



No. 895 for convectors and enclosed radiators

EQUIPMENT DEVELOPMENTS

Continued

Heat Pump Sections Have Nominal 15 Ton Capacities

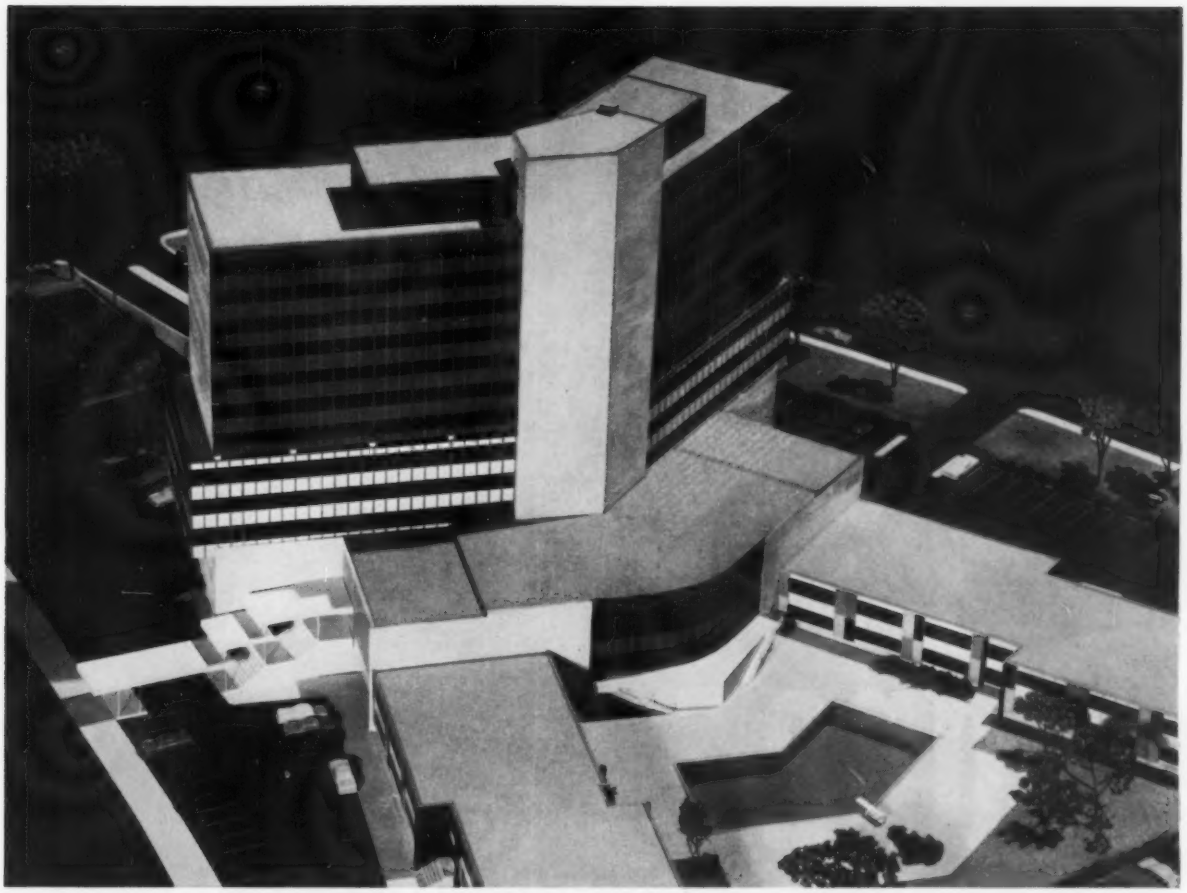
Outdoor sections have a low silhouette for hideaway rooftop installation. Three vertical discharge propeller type fans move 13,000 cfm at a low sound level. Accessory electric heaters can be mounted on the fan deck. A time guard control circuit prevents rapid cycling. Refrigerant subcooling enables the outdoor units to be located as much as 60 ft above or below the indoor units. Indoor section can be used with or without ductwork and has a matching plenum for free discharge of air. Cabinet can be mounted vertically or horizontally, suspended from a ceiling or floor mounted. — *Carrier Corp., Carrier Parkway, Syracuse* 1, *N. Y.*

Roll-Type Air Filters Available in 84 Sizes

Available with automatic (motorized and controlled operation) or manual drives, with or without media covers on either or both ends. Installation can be made in a variety of positions regardless of air flow direction. Media movement can be in either direction. Units can be attached directly in the duct. — *Farr Co., P.O. Box* 90187, *Airport Station, Los Angeles* 45, *Calif.*

Adhesive Compounds Available For Bonding Insulations

Two adhesive compounds with different characteristics for bonding glass fiber insulation to metal, lap seams on pipe insulation materials, cork or asbestos to various surfaces, and various polystyrene foams, fiber and insulation backed boards to aluminum siding. One compound may be used in temperatures ranging from −20 to 200 F; the other has an upper limit of 300 F. — *Arno Adhesive Tapes, Inc.*, 4100 *Ohio St., Michigan City, Ind.*



GOLDEN TRIANGLE MOTOR HOTEL, Norfolk, Virginia. Architect: Anthony F. Musolino; General Contractor: Blake Construction Company; Mechanical Contractor: Hicks & Ingle Company; Distributor for Anaconda: Hajoca Corp.

6 miles of Anaconda Copper Tube (½" to 5") installed "easier and quicker"

This recently completed, six-million-dollar development in downtown Norfolk contains more than 32,000 feet of Anaconda Copper Tube in sizes from ½" through 5" for hot and cold water lines. *Why Anaconda Copper Tube?* Howard C. Robinette, Division Manager for Hicks & Ingle, says, "We used Anaconda Copper Tube because of the ease in handling and quicker installation. We found it very advantageous in confined areas . . ."

Add to these cost-saving installation advantages, *longer life* and *less maintenance* and you have the reasons why Anaconda Copper Tube is so often the choice of those who demand quality in plumbing materials. For complete information about Copper Tube and Fittings for general plumbing, heating, air conditioning and refrigeration, write for free copy of Publication B-1, Anaconda American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario.

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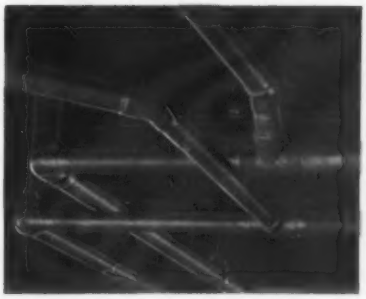

Making connections in tight places is no problem with Copper Tube and Solder-Joint Fittings.

ANACONDA®

COPPER TUBE AND FITTINGS

PRODUCTS OF ANACONDA AMERICAN BRASS COMPANY

Available through plumbing wholesalers

HORIZONTAL SPLIT CASE—DOUBLE SUCTION, SINGLE STAGE PACKED PUMP

A NEW, QUIET, VIBRATIONLESS PUMP

The new Chicago DPA pump is an exceedingly sturdy, quiet unit providing maximum hydraulic efficiency at all times. Suction, discharge openings and bearing housings are integrally cast into the lower case for maximum rigidity and perfect alignment.

Positive impeller positioning is assured at all times due to a novel and proven design of the rotating assembly. Removal of the entire rotating assembly for inspection is made easy and exact re-alignment assured.

The cast bronze impeller is hydraulically and dynamically balanced and the water passageways hand ground for smooth vibrationless operation. The extra deep stuffing boxes are tapped and bronze lantern rings provided for connection of water sealing.

Capacities to 2800 GPM

Heads to 290 Feet

Discharge Sizes 1½ to 8 inches inclusive

Temperatures to 250° F.

For further information contact your local Chicago Pump Distributor or write direct for Bulletin 102-A.

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Putting Ideas to Work

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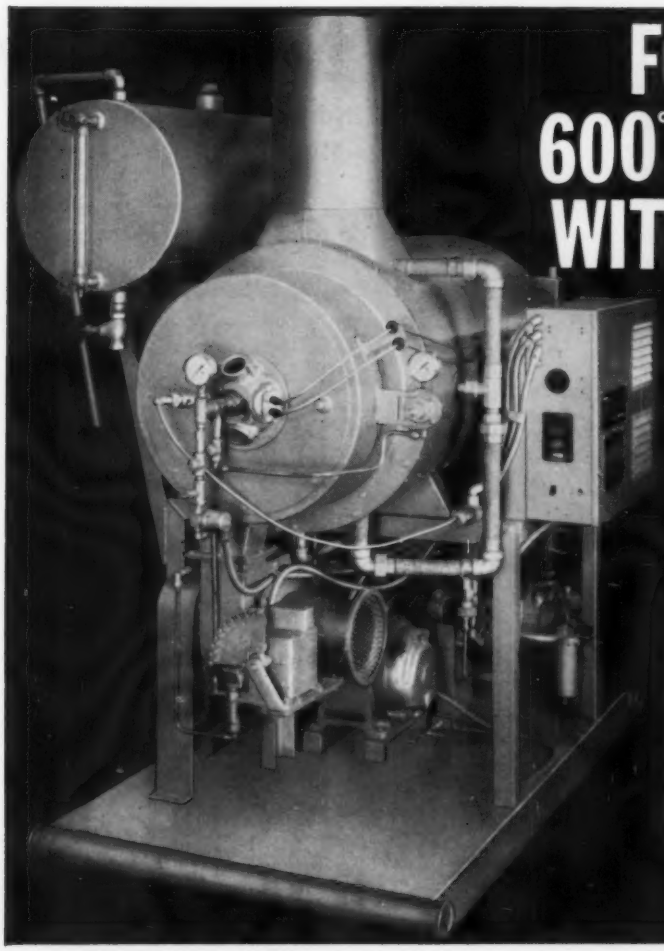
CHICAGO PUMP

622C DIVERSEY PARKWAY • CHICAGO 14, ILLINOIS



FOR 600° TEMPERATURES WITHOUT ANY PRESSURE!

VAPOR MODULĀTIC

HI·R·TEMP

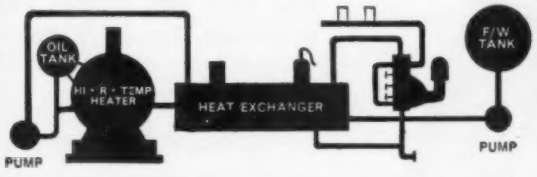
LIQUID PHASE HEATER

This Vapor Modulatic HI·R·TEMP Liquid Phase Heater uses heat transfer oils to provide dependable, automatic, accurately controlled heat transfer to 600° F., without high pressures. Burns natural gas, propane, butane, No. 2 diesel oil, or kerosene. Sizes to 13,000,000 b.t.u.

Check these advantages:

- ACCURATE TEMPERATURE CONTROL. Modulāting controls automatically maintain pre-determined temperature of heat transfer oil.
- NO WATER TREATMENT NEEDED. Eliminates cost of treatment system. No corrosion, scale, freezing problems.
- POSITIVE OIL FLOW. Rotary gear pump assures uniform circulation...prevents hot-spots, coking, sludging, oil breakdown.
- LOW INSTALLATION COST. Completely unitized, skid-mounted with all piping in place. Factory tested before shipment. Compact, lightweight...install it anywhere.
- LOW-PRESSURE VESSELS AND FLOW CIRCUITS. Saves the cost of heavy-duty piping, fittings, valves.
- COLD OIL SEAL. Expansion tank is uninsulated and isolated from main flow of hot transfer oil. Protects oil against atmosphere, sludging, deterioration.
- OPTIMUM SAFETY. Non-toxic. Built to ASME codes. Flame failure, low oil level, high temperature safety shut-off controls are standard. CO_2 quenching ring optional.
- LOW OPERATING COST. Forced-draft combustion, coiled tube design is highly efficient. No high pressures, does not require licensed engineer to operate.

here's how one vapor Hi·R·Temp, with heat exchangers, can supply your needs for processing, heating, hot water, etc.



Heated oil from HI·R·TEMP (at temperatures to 600° F.) passes through heat exchangers to provide steam for processing; at 450° for steam for heating plant and office; at 200° for hot water for cleaning, washing, other uses. Provides full, economical use of heat to lower your operating costs!

VAPOR

For complete information, send coupon today.

Vapor Heating Corporation, Dept. 21-H
80 East Jackson Boulevard, Chicago 4

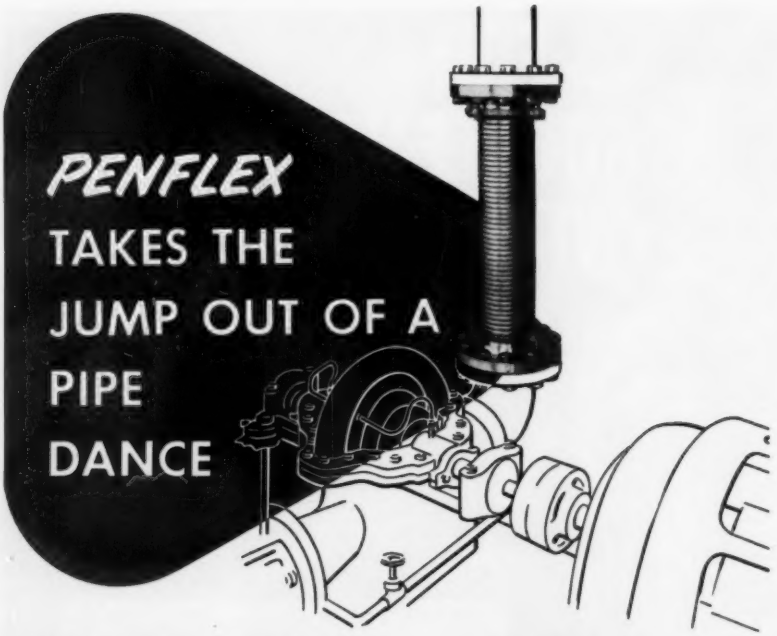
Please send me Bulletin 4023 on your HI·R·TEMP Liquid Phase Heater.

Name_____

Company_____

Address_____

City, Zone, State_____



DAMPENS VIBRATION . . . CORRECTS MISALIGNMENT . . . ABSORBS EXPANSION

When the lines get the jitters, the units get the breaks throughout the system. That's where a Penflex flexible connector should be installed.

These "Job-Proved" flexible connectors have been developed to soak-up the vibration in the refrigeration, heating and air conditioning lines in commercial and industrial installations. They correct the misalignment of pipes caused by pump or compressor motion and prevent pipe cracks and system breakdowns. As the lines become hotter or colder the Penflex connector expands or contracts . . . always assures a tight system with peak operating efficiency.

Flexible connectors, vibration dampeners, flexible lines have all been developed . . . thoroughly pre-tested by Penflex . . . and "job-proved" throughout the industry to be unsurpassed for trouble-free operating efficiency.

If you want your system to operate at its very best specify Penflex for flexibility at all temperature zones. Write for complete data to Pennsylvania Flexible Metallic Tubing Co., Paoli, Pa.

Penflex

TIGHT AS A PIPE . . . BUT FLEXIBLE

EQUIPMENT DEVELOPMENTS
Continued

Hydronic Zone Valve Operated by Motor

Controls water or steam in heating or cooling systems. Thermostatically controlled "VM-120" zone valve is a low voltage wing type for installation at the radiator or in the supply piping to the zone to be controlled. Synthetic packing provides protection against leakage. A 24 v electric motor requires no lubrication. Can be opened or closed manually if power fails; operating control will automatically take over when electric power is restored. Opening and closing speed: 30 sec each cycle. Has brass body and trim. Maximum water temperature limit is 250 F. Body rating is 50 psi maximum; highest operating pressure differential is 15 psi. — *General Controls Co., 801 Allen Ave., Glendale 1, Calif.*

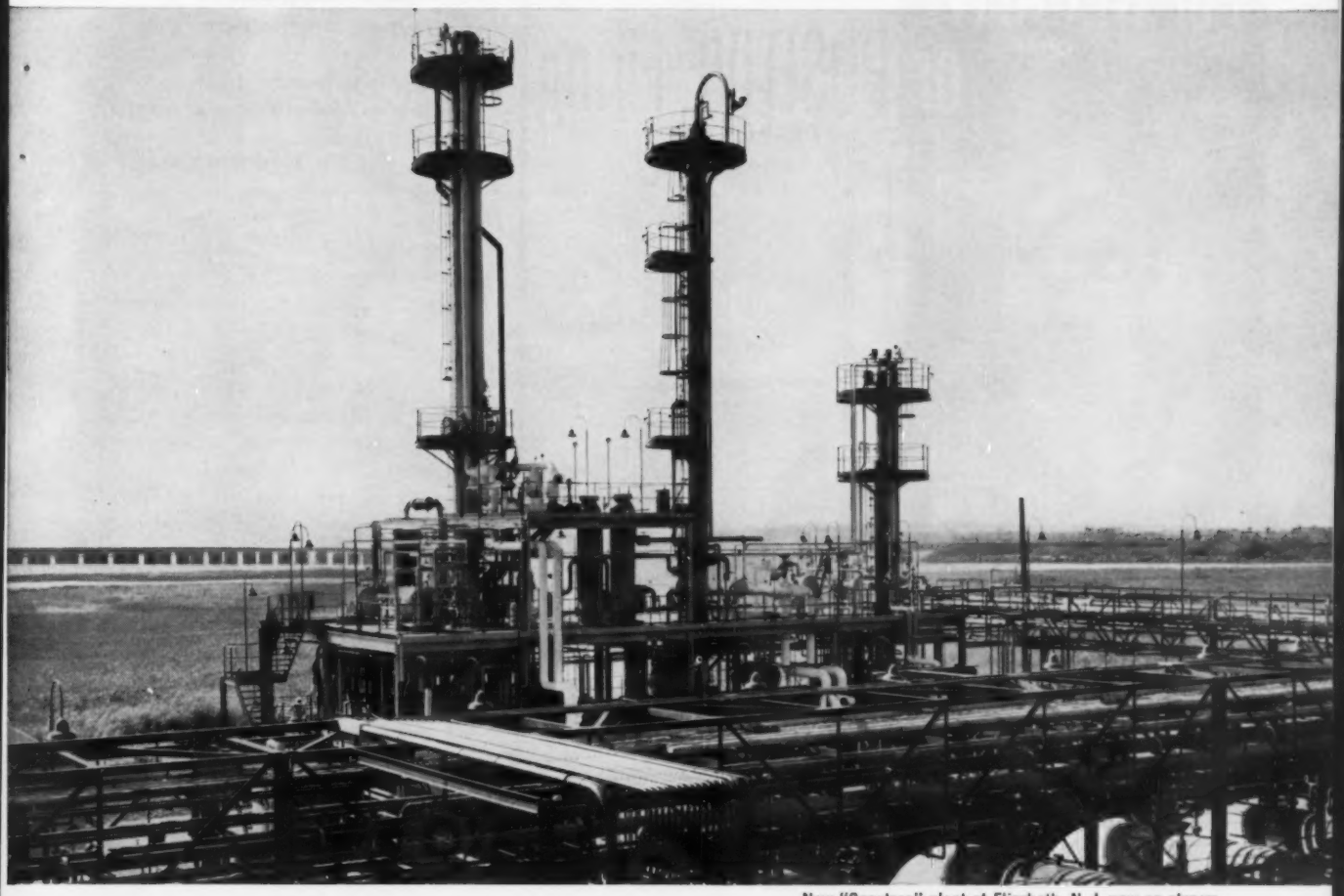
Permanent Air Filter Has Double Filter Element

Double filter element zips open and slides off an all metal frame so that material can be washed. Treated with "Thiuram," is non-allergic, non-toxic, and will not rot or mildew. Range of sizes available from 8 by 16 by 1 in. to 20 by 25 by 1 and 2 in. Literature sent on request. — *Auto-Flo Corp., 12085 Dixie St., Detroit 39, Mich.*

Slide Rule Sizes Gravity Roof Ventilators, Louver Houses

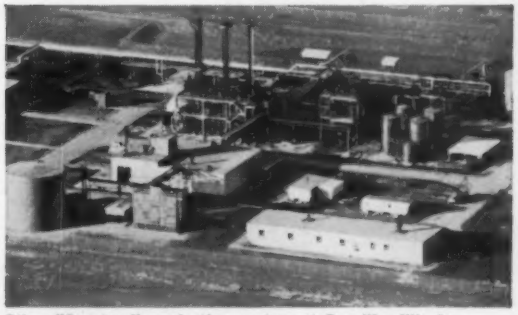
Provides a means to size gravity roof ventilators, pressure relief outlets, discharge caps, and fresh air intakes. Equivalent to six capacity tables, five pages of rating charts, and 10 mathematical formulas. Unit will be sent on letterhead requests. — *Penn Ventilator Co., Inc., Goodman above Allegheny Ave., Philadelphia 40, Pa.*

NOW 3 "GENETRON" PLANTS TO SERVE YOU!



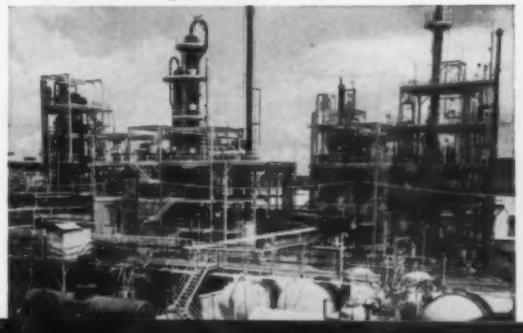
New "Genetron" plant at Elizabeth, N. J. now on stream.

Above: General Chemical's brand-new "Genetron" plant in Elizabeth, New Jersey has a capacity of more than 10,000 tons of "Genetron" per year. Its output will serve consumers throughout the Northeast. This large new plant is the third "Genetron" facility serving industry. It supplements production at Danville, Illinois, and Baton Rouge, Louisiana. These three highly efficient, big-capacity plants are three good reasons why General Chemical is your *dependable* source for highest quality fluorocarbon refrigerants and aerosol propellants. Be sure—always specify "Genetron."



Other "Genetron" production centers at Danville, Illinois

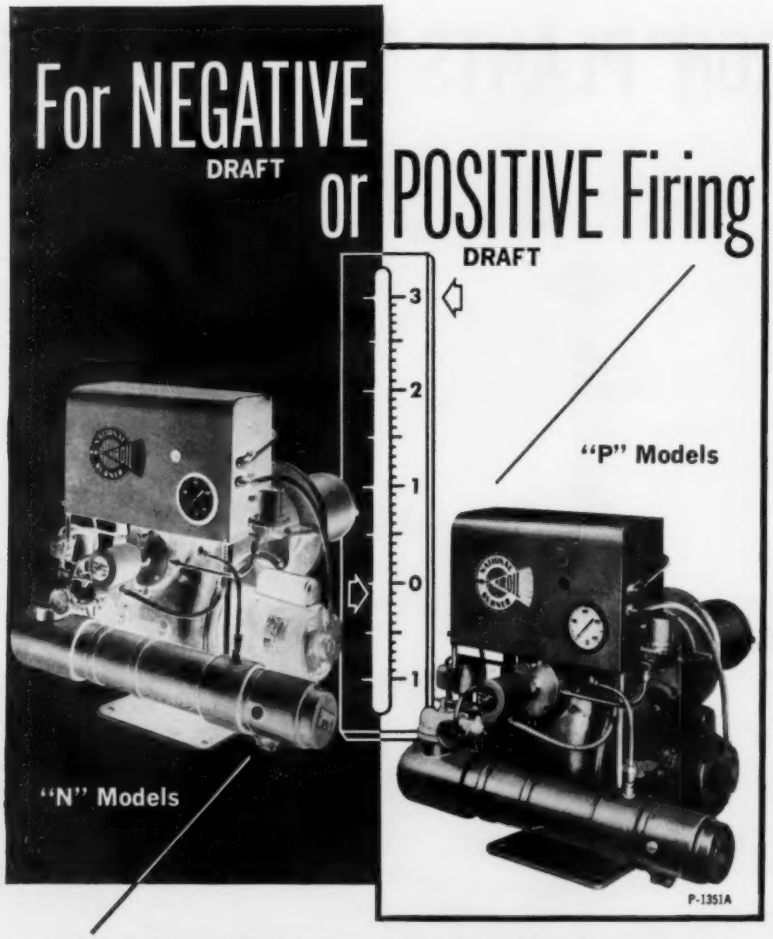
. . . and at Baton Rouge, Louisiana.



Allied Chemical

GENERAL CHEMICAL DIVISION

40 Rector Street, New York 6, N. Y.



Specify National Airoil Burners

Whatever your draft requirements . . . negative or positive . . . natural or induced draft, forced draft "pressurized" . . . there are TWO National Airoil **job-engineered** burners in 14 models available for top performance under the most severe service operations.

Select **TYPE C-45** for burning **Numbers 4 and 5** commercial fuel oils . . . **"N"** models operate with a **negative** draft of 0.05″ w.c. to 21 gph, 0.075″ w.c. to 33 gph . . . **"P"** models operate against a **positive** furnace pressure up to 3″ w.c. . . . quiet, easy to install, high temperature flame, excellent combustion, simple, sturdy construction, thoroughly field-tested and proved. Bulletin 100A.

Select **TYPE C-20,** a companion to the C-45 shown above, for burning the lighter **Number 2** fuel oil . . . **"N"** models operate with a **negative** draft of 0.05″ w.c. to 21 gph, 0.075″ w.c. to 33 gph . . . **"P"** models operate against a **positive** furnace pressure up to 3″ w.c. . . . clean, pulsation-free operation. Bulletin 102.

These Underwriter-approved **packaged** burners offer many outstanding first-time features. Data is contained in our comprehensive literature and specifications. Just tell us your needs and you'll hear from us by return mail.

Established 1912
Incorporated 1917

NATIONAL AIROIL BURNER COMPANY, INC.
1284 E. Sedgley Avenue • Philadelphia 34, Pa., U.S.A.
Industrial Oil Burners, Gas Burners and Combustion Equipment

EQUIPMENT DEVELOPMENTS

Continued

Centrifugal Pumps for All-Purpose Applications

End suction units for air conditioning, heating, and process applications can handle either clean or suspension carrying liquids. Type "BHO" available in 14 sizes, ranging from 1 to 5 in., made of cast iron alloys and bronzes. Temperature limits range from sub-zero to 350 F at pressures up to 250 psi. All but smaller pump can be close-coupled using standard motors with NEMA shaft extensions. A variety of volute positions is available. Can be supplied with packing or with either internal or external mechanical shaft seals. Literature sent on request. — *C. H. Wheeler Manufacturing Co., 19th St. and Lehigh Ave., Philadelphia 32, Pa.*

Gas-Fired Boilers Have Capacities to 675,000 Btuh

Capacities of "Type 22" boilers range from a three-section 150,000 Btu per hr input to a 10-section 675,000 Btu per hr input. Units for steam or hot water, gravity or forced circulation. All sections are of parallel ground construction. A seven-section boiler of 450,000 input requires only 9.4 sq ft of floor space. — *Mueller Climatrol, Div. of Worthington Corp., 2005 W. Oklahoma Ave., Milwaukee 1, Wis.*

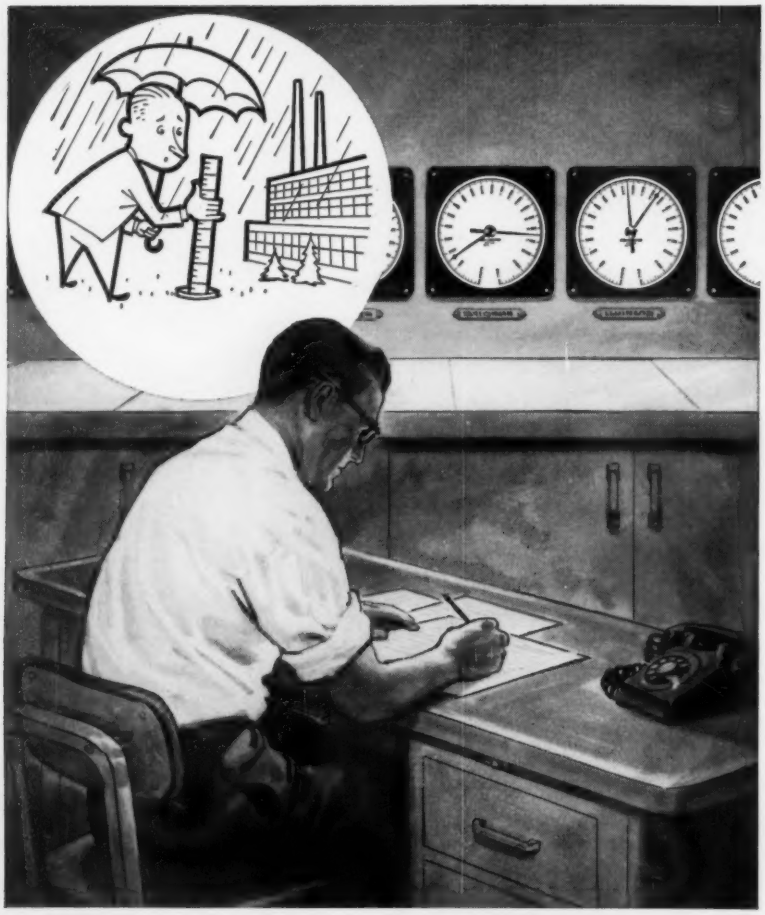
Hydraulic Pipe Cutter Can Be Used in Any Position

Two sizes available for 2 to 4 in. and 2 to 6 in. pipe. Cuts in any position: overhead, upside down, and sideways; in trenches, between studs, under crawlways. "Red Snapper" units for cast iron, soil pipe, "Duriron," clay or cement tile. Cut is in full view of operator to insure accuracy. — *Beaver Pipe Tools, Inc., Warren, Ohio.*

DUCT INSULATION ADHESIVE by Permacel—applied by brush, roller or spray, it quickly and permanently bonds acoustical or thermal insulation to sheet metal ducts. Maintains high flex strength, can be used over entire temperature range of −20° to 250°F.

PERMACEL®

NEW BRUNSWICK, NEW JERSEY • TAPES • ELECTRICAL INSULATING MATERIALS • ADHESIVES



Take the legwork out of liquid measurement

Here's practical liquid measuring—the modern way... without roaming all over the lot! Liquidometer Gauges let you inventory distantly stored liquids at a glance.

Completely automatic Liquidometer Gauges can be located as far as 250 feet from tanks. Think what this centralized system can mean in man-hours saved—let alone the additional safety of personnel who no longer have to trudge to, or tamper with, hard-to-get-at tanks.

Simple to install, and requiring no maintenance, Liquidometer Gauges measure virtually all liquids conveniently, continuously, and correctly. There's a type available for practically every liquid measuring application.

For complete details, write

LIQUIDOMETER INSTRUMENTS

THE LIQUIDOMETER CORP.

Dept. A, LONG ISLAND CITY 1, NEW YORK

EQUIPMENT DEVELOPMENTS

Continued

Electronic Air Cleaner Is Self-Contained

High velocity electrostatic precipitator has type "HVSC Electro-Cell" air filter and is designed for use in inaccessible areas and for use with air handling units. Has front and back duct connections, drain pan, and pre-assembled washing and oiling mechanism. Can be floor or ceiling mounted. Available in 24 sizes ranging from 1000 to 25,000 cfm. Efficiency as determined by the NBS Dust Spot Test Method is as high as 95 percent on normal atmospheric dust. Send for bulletin No. 258B. — *American Air Filter Co., Inc., Dept. PD,* 215 *Central Ave., Louisville* 8, *Ky.*

Air Cooled Condensers Rated Up To 60 Tons

Vertical discharge air cooled condensers available in 13 models ranging in capacity from 5 to 60 tons with dual units available up to 120 tons. Cross-fin coil has staggered copper tubes and aluminum fins. Drip proof NEMA-frame, ball bearing motors are housed within unit for weather protection. — *Larkin Coils, Inc.,* 519 *Memorial Dr., S.E., Atlanta* 1, *Ga.*

Forced Draft Boilers Rated Up To 1,928,000 Btu Per Hr

Packaged units include a sealed combustion chamber and a forced draft burner. Fired by No. 2 oil or gas: natural, mixed, or propane LP gas, and combination oil-gas. Low water line design units with extended water leg and horizontal tubular construction are available in 11 sizes ranging from 427,000 up to 1,928,000 Btu per hr. Requires only a vent for combustion product relief. — *Portmar Boiler Co., Inc.,* 193 *Seventh St., Brooklyn* 15, *N.Y.*

HERE'S HOW TO QUENCH THE THIRST OF A MODERN 22 STORY GIANT

Downstairs, upstairs and all around the house Peerless Pumps move up to 15,000 gallons of water every minute for the 55 Public Square Building in Cleveland.

Engineering a modern building for maximum human efficiency calls for water, plenty of water. Water for the air conditioning system, water for sanitation and human consumption. Water for a hundred and one other needs that a huge building like the 55 Public Square structure in Cleveland demands on a round the clock basis.

In the 55 Public Square building the assignment of handling this water has been given over entirely to Peerless pumps. Good reasons, too. First, in the Peerless line the contractor found a complete selection of models to handle his every requirement. During initial startup, when minor adjustments were required, Peerless field representatives were on hand immediately to handle the service requirements. Since that time, the Peerless pumps have operated on a continuous basis with no downtime, moving water all through the building with maximum performance.

Investigate the Peerless lineup of quality pumps for your next building. Large or small, you'll find that Peerless quality and service are unmatched. Write us today for our catalog and the name of your nearest Peerless representative.

Upper left: These Type A pumps are handling condenser water with a 130′ head.

Upper right: Peerless Type DL pumps circulate ethylene glycol to melt snow on walks surrounding the building.

Lower left: Type TU booster pumps handle house water with a 300′ head.

Lower middle: These vertical Hydro-Line® models are handling hot condensate.

Lower right: This series of Type A pumps are in chill water service.

Putting Ideas to Work

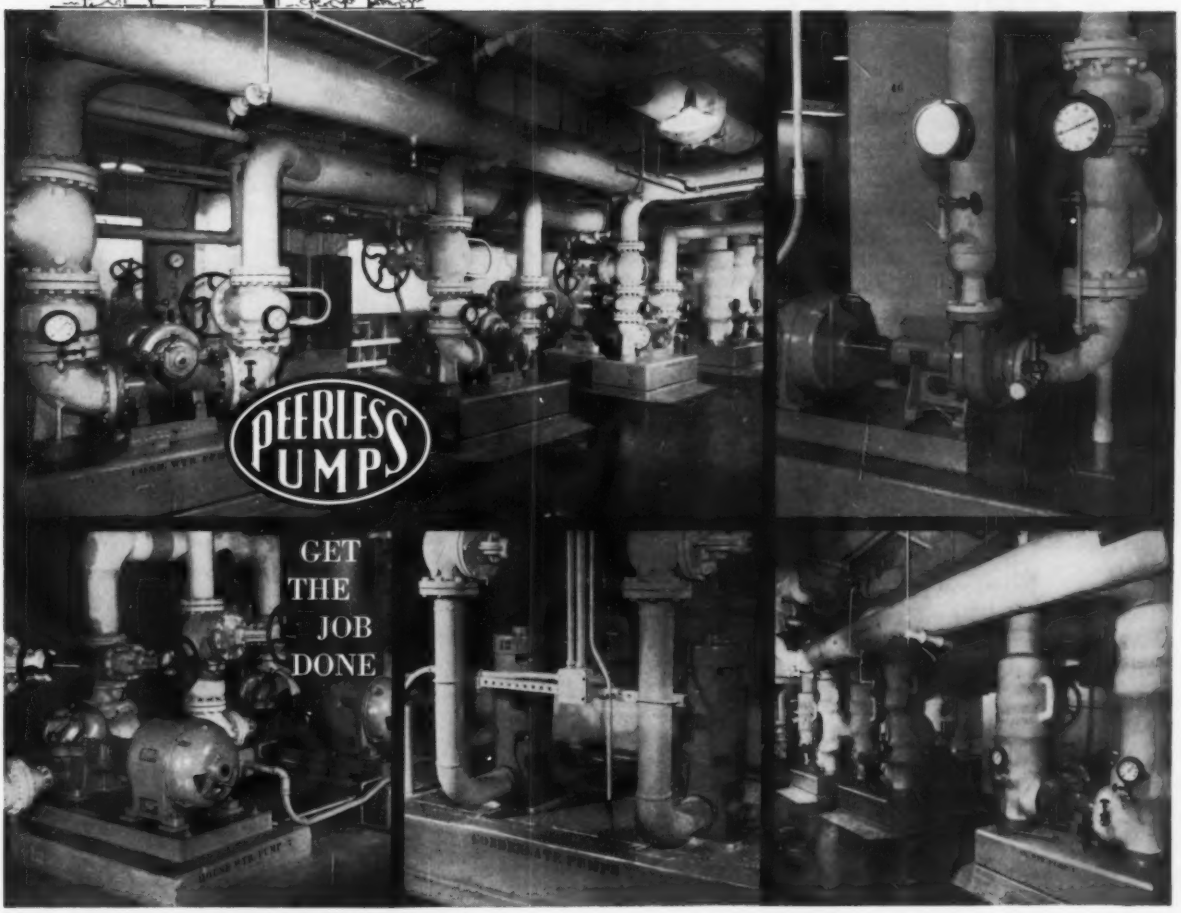
PEERLESS PUMP

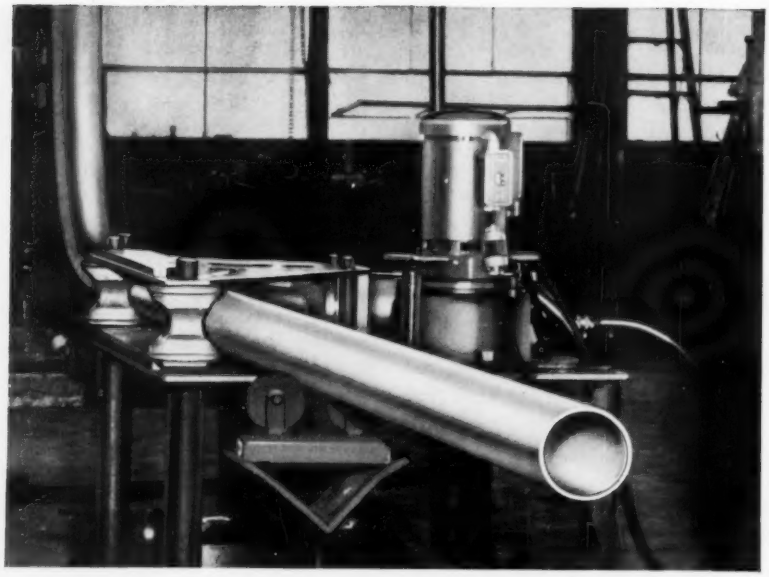
HYDRODYNAMICS DIVISION

Plants: Los Angeles 31 California, and Indianapolis 8, Indiana.

Offices: New York; Detroit; Chicago; Cleveland; Indianapolis; St. Louis; San Francisco; Atlanta; Plainview; Lubbock; Phoenix; Albuquerque; Los Angeles; Fresno.

Distributors in principal cities.
Consult your telephone directory.





"We reduced bending time 80% on 4" schedule 40, 316 stainless pipe with a GREENLEE BENDER,"

St. Louis fabricating shop reports

Corrigan Company, St. Louis, Missouri, reports that a bend as shown above formerly required four hours "prefabing" and welding time using fittings, couplings, etc. Using the Greenlee No. 884 hydraulic pipe bender, Corrigan now makes the same bend in 45 minutes—a saving of 80%.

According to the plant superintendent at Corrigan, "the Greenlee No. 884 makes it easier for us to bend and prefab. Also, when we weld, the bends often pull out of square. This is not true with our Greenlee bender. Leaking problems experienced with fittings and couplings also were eliminated."

Greenlee No. 884 hydraulic benders make bends up to 90° with one ram stroke in 10 sizes—½ to 4" of steel and aluminum pipe. When operated by a Greenlee hydraulic power pump, such as the No. 1722-SA shown in use above, the No. 884 makes 90° bends in 4" pipe in less than 2 minutes. The bender also may be operated by a Greenlee No. 1726 hand pump.

Are you missing important timesavings like these on your bending jobs? Ask your Greenlee distributor to help you select the exact bender needed to streamline your operation, help you control costs, and assure maximum return for your tooling dollar. Or, if you prefer, write for Bulletin E-240A.

GREENLEE TOOL CO., 1997 Columbia Ave., Rockford, Ill.

GREENLEE JOB-PROFIT TOOLING

. . . cost control for contractors

EQUIPMENT DEVELOPMENTS

Continued

Packaged Combustion System Uses Forced Draft

Will convert any commercial or industrial high or low pressure boiler to fully automatic operation, fired by gas, oil, or gas-oil. For use where forced draft is desirable. May be applied to any firebox where pressure does not exceed ¾ in. water gage at maximum firing rate. Available with four different models of horizontal rotary oil burners, a nozzle mix type gas burner, or a combination gas-oil burner in 10 sizes with maximum capacity from 15 to 175 gph for oil and 2200 to 25500 cfh for 1050 Btu gas. — *Preferred Utilities Manufacturing Corp., 41 E. 42nd St., New York 17, N. Y.*

Solenoid Valve For 500 Psi Operation

Two-way unit for normally open operation (valve opens when solenoid is de-energized) at pressures to 500 psi. Available in ½ in. pipe size with brass body, integral seat, and "Teflon" disc. Will handle air, water, or light oil at temperatures to 212 F. Standard listings are for d-c. Send for form No. V5132. —*Automatic Switch Co., Florham Park, N.J.*

Vaneaxial Blower Has 60 In. Diameter

Belt-drive unit will move 96,450 cfm at 2 in. SP (98.3 bhp) or 66,500 cfm at 7 in. SP (116.7 bhp). Line includes belt-driven models in 11 sizes from 12 to 60 in. and direct drive models in six sizes from 18 to 42 in. Units have cast aluminum-alloy impellers and all welded construction, with guide vanes welded to both inner and outer shells. Information sent on request. — *Hartzell Propeller Fan Co., P.O. Box 909, Roosevelt Ave., Piqua, Ohio.*

Control of thermal expansion in piping

Flexible support can prevent destructive stresses in high temperature piping

Heat 100 linear feet of alloy steel pipe to 1000°F, and it will expand approximately 9 inches! When this thermal expansion takes place in a piping system, the resultant forces — if uncontrolled — can do incalculable harm.

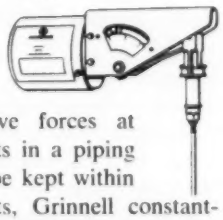
Helical coil springs

Using helical coil springs to compensate for thermal expansion in piping is now common practice. However, designing or selecting flexible supports is often done haphazardly. In fact, any specifications covering the support of important high temperature piping simply say "spring hangers shall be provided." But it is not enough to merely admit that thermal expansion may be dangerous.

Safety of entire system at stake

Careful study must be given to the design and selection of spring supports which will maintain a balanced piping system. If not, the transfer of weight from one hanger to another, or from a hanger to a terminal point, will endanger the safety factor of the entire system. Today, you're often confronted with 8–9–even 10 inches of thermal deflection. That's why flexible support for piping in all positions of travel is a definite "must"!

Constant-support hangers

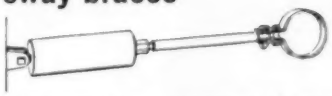


Where reactive forces at terminal points in a piping system must be kept within specified limits, Grinnell constant-support type hangers are recommended. They are designed to provide uniform supporting force equal to the pipe load throughout the range of thermal movement. Constant-support hangers should be used at superheater outlets, turbine connections, and on high temperature and other critical lines.

Variable spring hangers

When pipe lines are subject to vertical movement — and restrictive conditions do not require a constant-support hanger — variable spring hangers are recommended. They should be designed for a maximum variation in supporting effect of 25% for the total travel resulting from thermal conditions.

Vibration control and sway braces

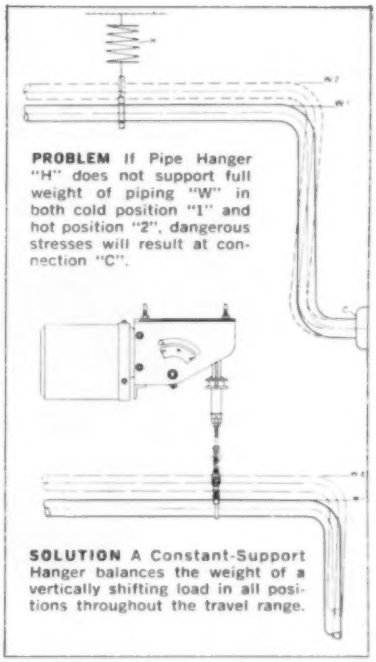


When you have to prevent abnormal movement or vibration in pipe lines, controls or sway braces of the energy-absorbing and instant-acting counter force type are recommended. They dampen vibration, oppose pipe sway, absorb shock.

Grinnell Hanger Engineering Service

Grinnell Company's Pipe Hanger Department offers design service to engineers who appreciate the specialized knowledge required. Grinnell will help you compute hanger loads . . . and select proper supports for a *balanced* pipe suspension system.

What's more, Grinnell manufactures a complete line of pipe hangers and supports — and offers stocks of pipe hangers close to any job!


PROBLEM If Pipe Hanger "H" does not support full weight of piping "W" in both cold position "1" and hot position "2", dangerous stresses will result at connection "C".
SOLUTION A Constant-Support Hanger balances the weight of a vertically shifting load in all positions throughout the travel range.

Grinnell maintains an experienced staff of technicians to discover better ways of solving pipe suspension problems, too.

Hanger load calculation booklet

Grinnell will be glad to send you — without obligation — a 32-page booklet, "Calculations for Hanger Loads and Thermal Movements". This helpful booklet furnishes necessary data and procedures to determine pipe hanger loads and thermal movements. Tabulations of piping weights and thermal expansion are arranged for convenient selection of data that usually takes considerable time to develop. Send for your copy *today*. Grinnell Company, Providence 1, R. I. Branch Warehouses in Principal Cities.

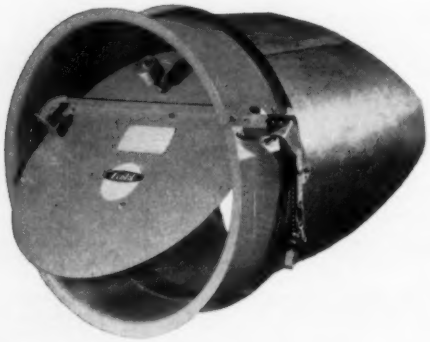
Don't design a

DRAFT SHORTAGE

into your

GAS BOILER

installations



Specify a double-acting

field

DRAFT CONTROL*

*With a Field the draft assistance of the chimney becomes available to the boiler for abundant draft at all firing rates, precisely controlled to the optimum twelve-to-one air-to-gas ratio recommended for clean, bright, efficient combustion. For 5" through 34" flue outlets. Write for specification data.

Specify Field Draft Controls for gas, gas-oil, oil or coal, for boilers, furnaces, incinerators, with natural, forced or induced draft, 5" through 34" flues.

FIELD CONTROL DIVISION

Conco Engineering Works, Inc., Mendota, Illinois

AFFILIATES: Spartan Tool Division — Powered Sewer Cleaning Equipment
Materials Handling Division — Cranes, Hoists
Conco Building Products, Inc. — Brick, Tile, Stone
Chicago Tramrail Division — "Trak-Rak" Stacker Cranes, Monorail Systems, "Fas-Lok" Storage Racks

EQUIPMENT DEVELOPMENTS

Continued

Industrial Centrifugal Fans Have Airfoil Blading

Heavy duty series "8500" fans have direct-connected motors producing capacities from 15,000 to 450,000 cfm. Motor speeds are 1800, 1500, 1200, 900, and 750 rpm. Includes 10 sizes of AMCA Class III-type fans with wheels from 30 to 81 in. in diameter; and 14 sizes of AMCA Class IV-type fans with wheel diameters from 30 to 109 in. Units can handle air from −20 to 800 F. Features bearings that are integral with the fan unit. Made of heavy steel, welded and reinforced. — *Westinghouse Electric Corp., Sturtevant Div., Dept. T-292, Damon St., Hyde Park, Boston* 36, *Mass.*

Thermistor Thermometer Covers —112 to 72 F Range

Transistorized unit covers range in three overlapping steps. Absolute accuracy is 0.9 F; readability is 0.45 F; and reproducibility is better than readability. Particularly useful in low temperature testing and environmental studies. Utilizes thermistor sensing elements with 10 ft leads; leads can be 1000 ft long without noticeable error. Battery powered, portable model "42SL" is housed in an aluminum case, 5½ by 4 by 6 in. — *Yellow Springs Instrument Co., P.O. Box* 106, *Yellow Springs, Ohio.*

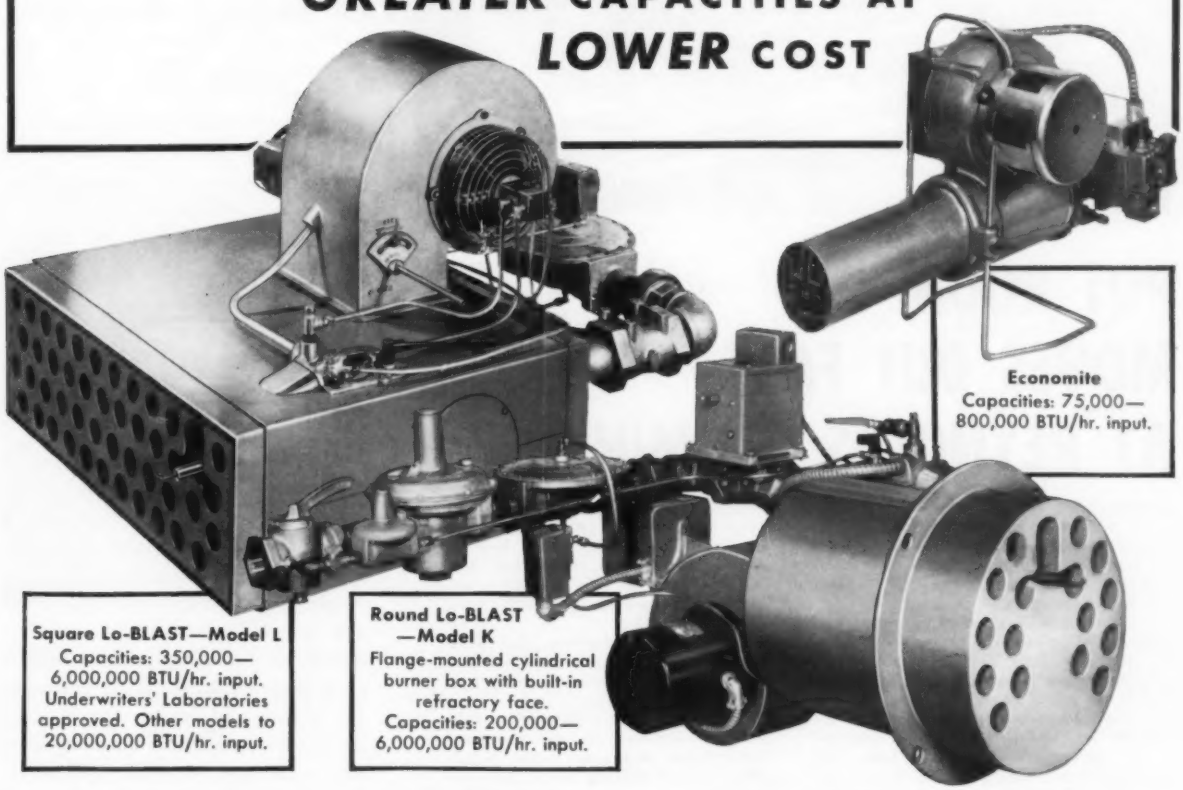
Penetrant Removes Rust, Frees Locked Fittings

Penetrant loosens rusted shafts, connections, piping, and other assemblies. Contains no acid, alkali, or other harmful ingredients; safe to skin, clothes, metal, etc. Contained in plastic squeeze bottle with 14 in. flexible extending spout. — *Armite Laboratories,* 6609 *Broad St., Los Angeles* 1, *Calif.*

LO-BLAST

AND *ECONOMITE*

POWER GAS BURNERS NOW AVAILABLE IN *NEW* ADVANCED DESIGNS... *GREATER* CAPACITIES AT *LOWER* COST



Square Lo-BLAST—Model L
Capacities: 350,000—6,000,000 BTU/hr. input. Underwriters' Laboratories approved. Other models to 20,000,000 BTU/hr. input.

Round Lo-BLAST —Model K
Flange-mounted cylindrical burner box with built-in refractory face. Capacities: 200,000—6,000,000 BTU/hr. input.

Economite
Capacities: 75,000—800,000 BTU/hr. input.

Over the years Lo-BLAST and Economite Power Gas Burners have established a solid reputation for dependable, low-cost operation. Now complete re-designing to add new engineering features to the tried and proved Lo-BLAST principles and to permit improved manufacturing methods has resulted in a *lower cost per BTU of capacity!*

Both burners save money because they eliminate the fuel waste caused by uncontrolled draft. A power-type burner provides a constant, metered supply of both air and gas independent of varying draft conditions. Perfect combustion at all times is the result, *with savings up to 10%!*

The Lo-BLAST Burner does not depend upon natural draft, but upon air supplied by a small, *quiet* blower. It provides both primary and secondary combustion air *only when the burner is on.* When the burner shuts off, the flow of air shuts off. The heating plant thus retains much of its heat between operations.

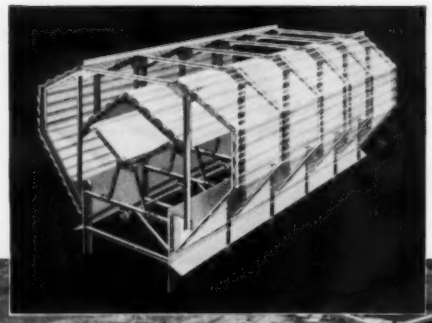
Lo-BLAST Burners eliminate the need for high chimneys—"inshot" design and complete factory assembly reduce installation and maintenance costs. Each unit is factory-tested on gas before shipment.

Whatever you heat, you can do it for less with Lo-BLAST!

Send for descriptive literature and engineering data.

MID-CONTINENT
METAL PRODUCTS COMPANY

2717 N. Greenview Avenue • Chicago 14, Illinois



Burt Monovent Continuous Ridge Ventilator converts roof ridge to a quick-acting, giant air valve . . . economically

POT ROOM AIR MOVES OUT FAST AT REYNOLDS ALUMINUM

The huge new Reynolds Metals Company's aluminum plant at Sheffield, Alabama, conditions the air in each manufacturing operation with a carefully engineered system of modern Burt Ventilators.

On the pot lines, where the snow-white alumina powder is transformed into aluminum in a bath of molten cryolite—where great crucibles of molten metal swing down the aisles — 84" aluminum Burt Monovents keep the air moving out fast. Over 7,200 lineal feet of this continuous ridge type Burt ventilator—more than 1⅓ miles—ventilates the nine pot line buildings uniformly and economically. Nearly 400 lineal feet of 60" Burt Monovent conditions the service building.

Atop the adjoining rectifier building, with its thousands of square feet of electrical equipment, twenty-five 54" aluminum Burt Free Flow Fan and Gravity ventilators provide fast, big-volume exhaust.

Thirty additional aluminum Burt Free Flow Gravity ventilators serve the pin cleaning, coke and ore unloading and carbon paste buildings.

In the big Reynolds installation only two Burt ventilator types were required. Other types and sizes might better solve your air moving needs. You will find them all readily available in the complete line of time-proven, modern Burt Ventilators.

Send for **FREE** *Data Book!*

Write for Burt Data Book SPV-101-1-60
It supplies quick data on Burt's complete line of modern Roof Ventilators.

FAN & GRAVITY VENTILATORS • LOUVERS • SHEET METAL SPECIALTIES

The Burt Manufacturing Company

41 E. South St. Akron 11, Ohio

MEMBER AIR MOVING & CONDITIONING ASSOCIATION, INC.

EQUIPMENT DEVELOPMENTS

Continued

Duct Insulation Has High Strength, Rigidity

Spun mineral fiber duct insulation has a breaking strength exceeding 8 lb for a 1 in. thickness 6 in. wide. "E-Z Ply" available either plain or with the following faces: paper vapor barrier bonded with a thick coat of high-penetration asphalt; scrim-reinforced aluminum foil laminated with flame-proof paper; embossed aluminum foil; and neoprene. Has a K factor of 0.24 at a mean temperature of 75 F. Maximum temperature limit is 450 F. Available in 2 by 4 ft panels in thicknesses of 1, 1½, and 2 in. Samples and information sent on request. — *Baldwin-Ehret-Hill, Inc., 500 Breunig Ave., Trenton 2, N. J.*

Instrument Measures Low Temperature Differentials

Measures very low temperature differences such as Btu output on hot water boilers or Btu removal by chilled water air conditioning systems. Utilizes firm's recorders for amplifying and recording. Two standard assemblies available: one is adjustable for a temperature difference range of 15 to 25 F; the other for a range of 50 to 200 F. Also measures and controls humidity over narrow ranges. — *Hagan Chemicals & Controls, Inc., Hagan Center, Pittsburgh 30, Pa.*

Hydraulic Pipe Squeezer Can Close 4 In. ID Steel Pipe

Seventy-five ton unit can close 4 in. ID steel pipe in 125 sec against 100 psi line pressure. Provides emergency shutoff. Portable unit is 30½ in. high, 13⅜ in. wide, and 7½ in. deep, and weighs 225 lb. Information sent on request. — *Regent Jack Manufacturing Co., Inc., 11905 Regentview Ave., Downey, Calif.*

A NEW ADVANCE IN REDUCING FIRE HAZARDS

Now Available – A Permanent Non-Combustible Vapor Barrier

For Use as Facing for Insulation, Pipe Jacketing, Duct Lining

The non-combustible properties of this vapor barrier, called PYRO-KURE, will not migrate or leach out.

It is the only vapor barrier on the market that offers this permanent, fire retarding property!

It is the first and only vapor barrier with an unqualified U/L flame spread rating!

Here is an important contribution toward the concept of "total fireproofness" that architects, contractors and building management are demanding today.

Pyro-Kure is a "sandwich" of various combinations of foil, paper or plastic film. It can also be reinforced to supply amazing additional strength that gives it extra long life and makes it easy to apply.

As a line of vapor barrier facing they have a perm rating of 0.1, or less, and are attractive in appearance.

Pyro-Kure is self-extinguishing when its combustion temperature is reached. It is the *only* vapor barrier with an unqualified Underwriters' Laboratories Flame Spread Rating. Its ratings are: 25 for the kraft side; 5 for the foil side.

You will want to know more about this development, perhaps for a current project. Write to our main offices in Attleboro, Mass. for a complete file of data, facts, figures and samples.

reinforced paper, foil, plastics and other products for construction, industrial packaging and agriculture

American **SISALKRAFT** Company

DIVISION OF ST. REGIS PAPER COMPANY

Sales Offices: ATTLEBORO, MASS., CARY, ILL., SAN FRANCISCO
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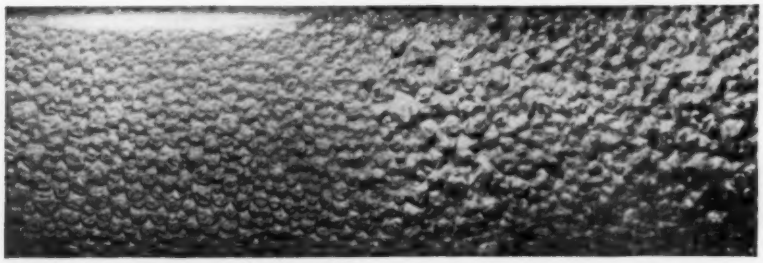
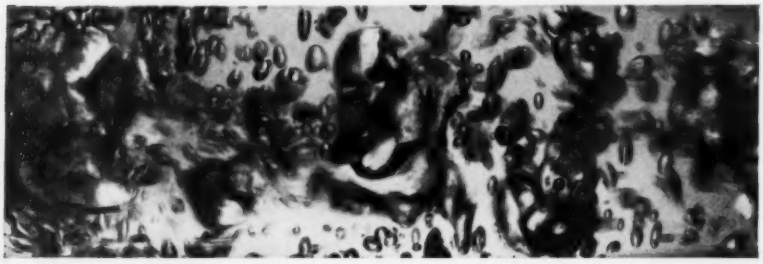
CARRYOVER



Foam build-up in untreated boiler water

No foam in boiler water treated with Concentrol



MUST BE STOPPED!

Carryover of solids due to foaming is in most cases continuous. Suspended matter helps the foam layer build up so that steam bubbles, with their entrained boiler water, do not break quickly at the steam-water interface. Thus, boiler water is carried over into the steam mains.

Many plants with wet steam problems have determined that carryover must be stopped and have turned to the Bird-Archer Company for an economical solution. Bird-Archer research in stabilizing boiler water with high foam potential is backed by 60 years experience. The result is the development of a highly effective antifoam agent called CONCENTROL. Even when used in relatively small dosages Concentrol is effective in combining both resistance to hydrolysis or breakdown under boiler temperatures and pressures with ability to control foam.

Write for Bulletin on "Concentrol", and name of the Bird-Archer Service Engineer nearest you.

BA102

BIRD-ARCHER

WATER TREATING CONSULTANTS

The BIRD-ARCHER Company, 4337 N. American St., Phila. 40, Pa. / New York • Chicago

The BIRD-ARCHER CO. of California, 415 Brannan St., San Francisco•Offices in Canada and Mexico

EQUIPMENT DEVELOPMENTS

Continued

PVC Plastic Sheets For Ducts, Hoods, Covers

"Kaylite" laminate combines the strength and formability of a thermoplastic-fiber laminate with the physical and chemical-resistant qualities of rigid polyvinyl chloride. Tensile strength is 200 psi; flexural strength is 4100 psi. Not affected by high temperatures until after 250 F. Has a relatively low coefficient of expansion and contraction. K factor of 1.85 Btu per hr per sq ft per F per in. provides qualities of thermal, accoustical, and electrical insulation. Can be joined by many processes, including the hot-air welding method for thermoplastics. — *Kaykor Industries, Inc., Yardville, N. J.*

Pressure Controllers Have Adjustable Proportional Band

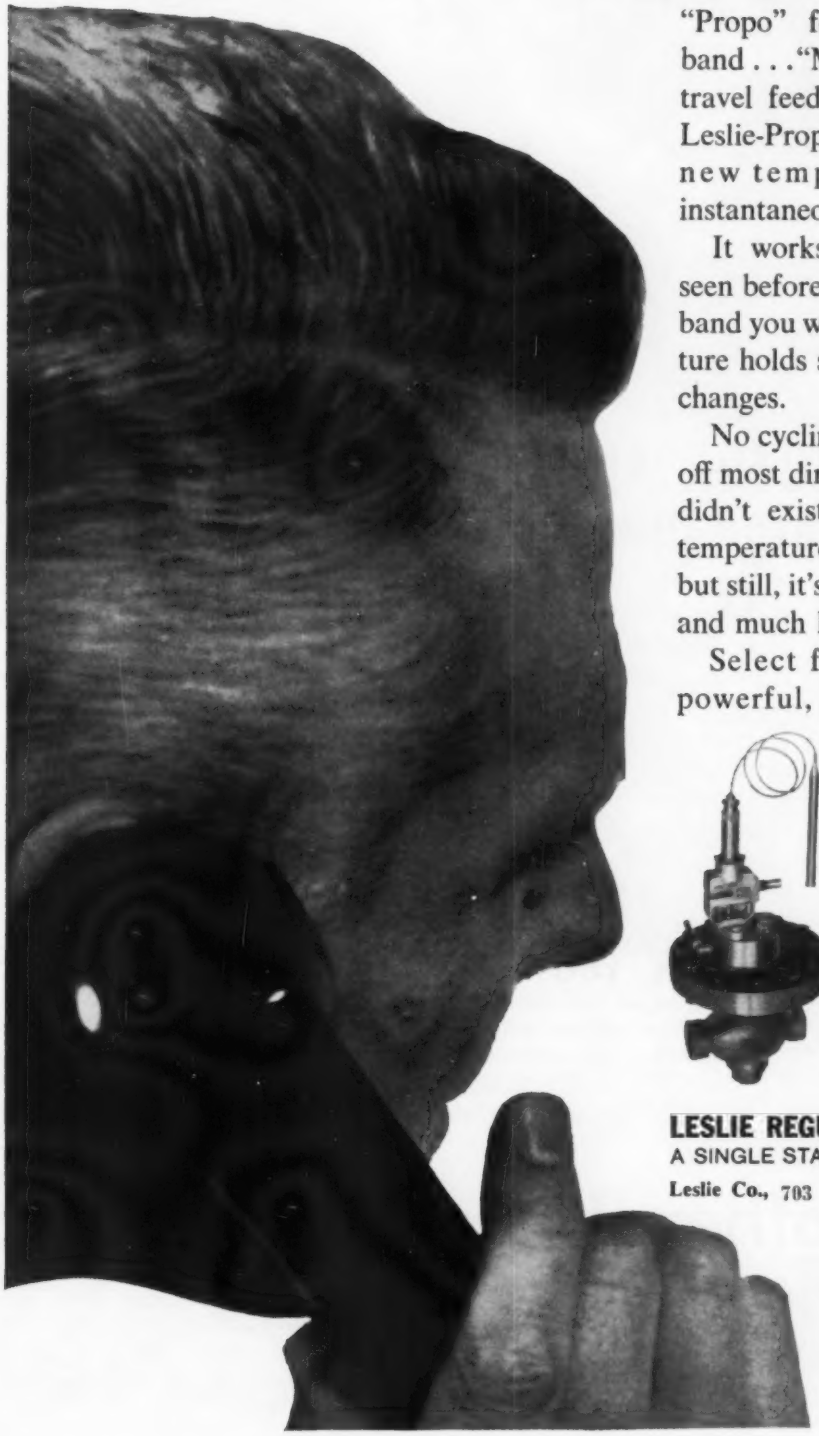
Available in both direct acting and reverse acting models for the control of steam, gas, or liquids. Can be used in corrosive service, and cannot be damaged by weather in outdoor installation. Information sent on request. — *Leslie Co., 105 Delafield Ave., Lyndhurst, N.J.*

Continuous Threaded Rods Support Duct, Pipe

Supports heating, piping, and air conditioning ducts and units, and other applications. Standard lengths of "Unirod" from 2 to 12 ft, in National Coarse thread from 6 gage to 2½ in. in diameter, and in National Fine thread from 6 gage to 1 in. diameter. Steel finishes include oil, blue rust resistant, and zinc plated. Brass rod available in standard lengths from 12 to 36 in., from 6 gage up to ¾ in. diameter, in National Coarse thread. Information sent on request. — *Unistrut Products Co., 933 W. Washington Blvd., Chicago 7, Ill.*

The best name we can think of is

PROPOMATIC



"Propo" for adjustable proportional band . . . "Matic" for automatic valve travel feedback. Put them together — Leslie-PropoMatic® — and you get the new temperature regulator for instantaneous-type heater service.

It works like nothing you've ever seen before. Set the dial for the control band you want, and that's all. Temperature holds steady, even under fast load changes.

No cycling. It's stable! And it shrugs off most dirty steam problems as if they didn't exist. In *effect* it's a pressure-temperature cascaded *control system* — but still, it's a *regulator* — easy to install, and much less in initial cost!

Select from 50F, 100F or 200F powerful, interchangeable thermo elements. Bronze or iron, ½ to 4″, screwed or flanged ends. PropoMatics handle inlet pressures to 150 psi, temperatures as high as 500F.

Engineering Data Bulletin 611 has all the data on PropoMatics. Send for it — no obligation.

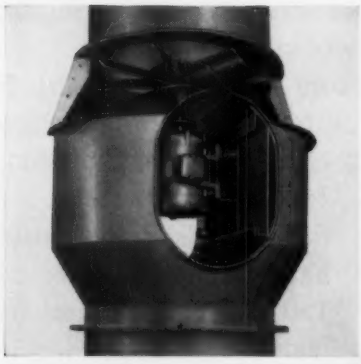
LESLIE REGULATORS AND CONTROLLERS

A SINGLE STANDARD OF QUALITY SINCE 1900

Leslie Co., 703 Grant Ave., Lyndhurst, New Jersey

TRADE LESLIE MARK

SLIDE-OUT MOTOR AND FAN* cut your maintenance costs



Simply removing patented half-section of cone (left) allows motor-and-fan assembly to slide on rails (above) right out of DeBothezat Bifurcator for quick and easy inspection and maintenance. Bifurcator housing, originally installed as a section of the duct work, remains in place. This ease and convenience result in quick work which sharply cuts your maintenance costs.

DIRECT DRIVE CUTS COSTS, TOO

Direct drive eliminates inefficiency and maintenance problems of belts, yet motor operates in cool, clean air. Twin ducts of Bifurcator carry abnormally hot, corrosive or explosive fumes **around** motor, isolate it from destructive fumes handled by direct-drive exhaust fan. Fan wheels available from 12" to 48".

**Optional extra. Patents Pending.*

Write for illustrated Bulletin DB-7-61

De Bothezat®

DE BOTHEZAT FANS DIVISION OF

American Machine and Metals, Inc.

Dept. HPA-861, EAST MOLINE, ILLINOIS

Divisions of American Machine and Metals, Inc.

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EQUIPMENT DEVELOPMENTS

Continued

Steam Traps Drain Condensate, Vent Air in Lines Up To 2 In.

For use in heating and low pressure systems such as unit heaters, ventilators, steam main and riser drips, and similar applications. Capacities range from 50 to 5750 lb of water per hr. Choice of $\frac{3}{4}$, 1, $1\frac{1}{4}$, $1\frac{1}{2}$, and 2 in. connections with maximum gage pressure of 15 psi. Can be supplied with a thermostatic air by-pass or without element for manual venting or external air by-pass. Send for bulletin 661. — *The V. D. Anderson Co., Div. of International Basic Economy Corp., 1935 W. 96th St., Cleveland 2, Ohio.*

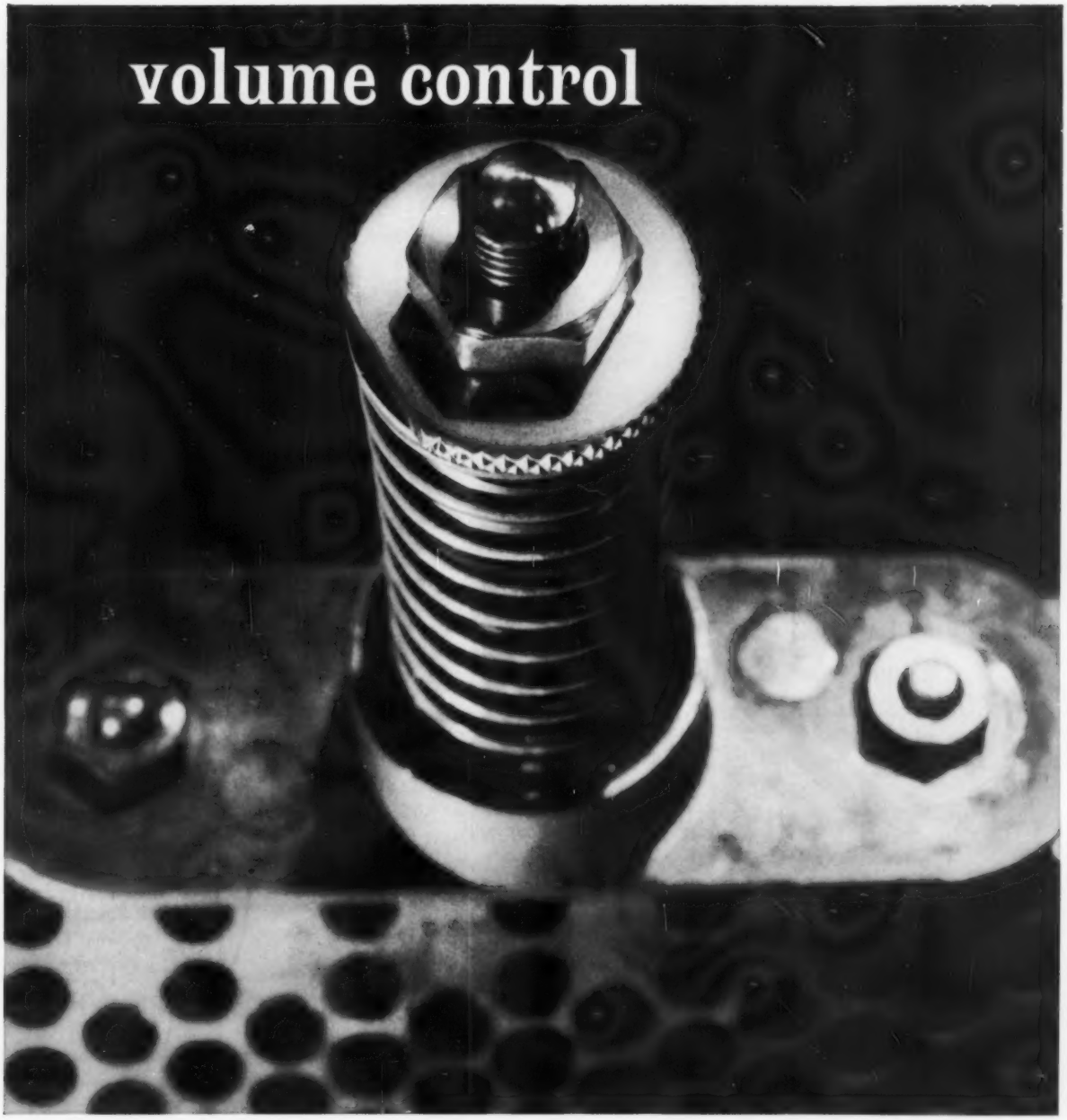
Heat Pump Available In 3 Ton Packaged Unit

Air cooled unit for year 'round operation can be mounted in the attic, crawl-space, basement, or on the roof. Can be installed all inside, half inside, or all outside. Equipped with a 6 kw strip heater which is automatically energized whenever unit enters defrost cycle; heavy duty compressor that operates at 130 F ambient temperature; propeller-type condenser fan; double drain pan; hermetically sealed system; and refrigerant circuit protection. — *Gaffers & Sattler, 8111 W. Beverly Blvd., Los Angeles 48, Calif.*

Valve Positioner Based On Force-Balance Principle

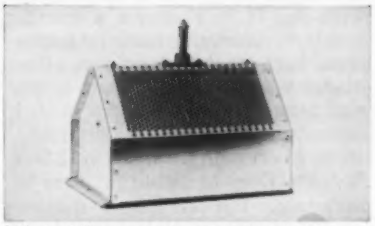
May be used either as a simple controller or as a position-indicator-transmitter, in addition to its prime function of providing response for diaphragm actuators. Has either direct or reverse acting response. Field adjustments and calibration can be made with a screwdriver and a wrench. Optional feature allows servicing without loss of process control. Send for bulletin 98414. — *Taylor Instrument Cos., 95 Ames St., Rochester 1, N. Y.*

volume control



All it takes is a turn of this knurled nut to adjust a Buensod Dual Duct air mixing unit for the exact air volume desired. (The smaller nut locks the adjustment.) And constant volume is maintained ±5% regardless of static pressure variance. There's never a problem of system balancing, no sudden blasts or cut-down due to operation of other zones in the system.

Dual Duct high velocity air conditioning fits new structures or renovations with equal ease. Consider this advanced, year-'round system for inclusion in your next project.



This tent-like apparatus is the heart of Buensod's Automatic Volume Control.

BUENSOD-STACEY CORP. · MANUFACTURED PRODUCTS DIVISION

BUENSOD-STACEY

45 West 18th Street · New York 11, N. Y. · Subsidiary of Aeronca Manufacturing Corporation

NOW

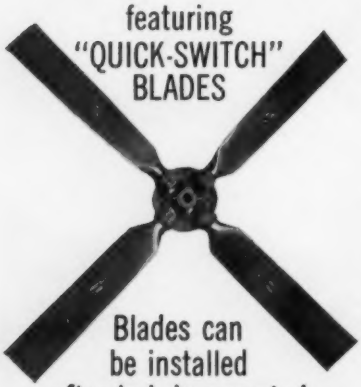
competitively priced!

NEW

Aeromaster
INDUSTRIAL COOLING

FAN

featuring
"QUICK-SWITCH"
BLADES



Blades can
be installed
after hub is mounted
on drive shaft

Performance, construction, and price make this the "best buy" in industrial fans! Delivers more CFM with *less* H.P. Features a ductile iron hub, removable blade retention caps, heat treated aluminum alloy blades with constant chord width and flanged ends. 4, 6 and 8 bladed fans available in 54" to 120" diameters. Maximum tip speed is 15,000 ft./min. Easy to install . . . easy to maintain. For complete details, write: KOPPERS COMPANY, INC., 4603 Scott Street, Baltimore 3, Md.

KOPPERS Aeromaster Fans

Engineered Products Sold with *Service*

EQUIPMENT DEVELOPMENTS

Continued

Heat Exchanger Cools Fluids for Sample Purposes

Sample cooler for high temperature, high pressure fluids such as boiler water, steam, feedwater, and hot chemical solutions. Counterflow type, cooler features a coil within a shell construction. Inner coil is made of inconel seamless tubing encased in a seamless, stainless steel outer shell. Available with screwed or ½ in. socket welding adapter connections for any piping system. Can be mounted with brackets or in the piping. Information sent on request. — *Hagan Chemicals & Controls, Inc., Hagan Center, Pittsburgh* 30, *Pa.*

Air Filter Has Water-Repellent Media

Glass-micro-fiber filter has a permanent water repellent for moisture resistance. Unit acts as a water coalescer and separator. Some models are resistant to temperatures as high as 800 F. Minimum efficiency is 99.97 percent removal of particles down to 0.3 micron diameter. Dust penetration is never greater than 0.03 percent by particle count. Frames are available in standard plywood, fire retarded plywood, fiberboard, and protective finished steel. — *Mine Safety Appliances Co.,* 201 *N. Braddock Ave., Pittsburgh* 8, *Pa.*

Pipe Thread Sealant Tape Available in Three Lengths

"Scotch No. 48" unfused TFE-fluorocarbon tape provides a permanently lubricated, leak-proof, freeze-proof joint that will not dry out. Can withstand operating temperatures ranging from those of liquid oxygen through superheated steam, and is not affected by oils and greases. Tape does not corrode or stick. — *Minnesota Mining and Manufacturing Co., Dept. W*1-284, 900 *Bush Ave., St. Paul* 6, *Minn.*

Babbitt
Adjustable
SPROCKET RIM
with Chain Guide
Changes that Danger Zone
to a
SAFETY ZONE

—*enables*
you to
ADD
PLANT
AREA

If re-aligning equipment will yield more working space, better production, lower costs—do it now. Save all space wasted for placing ladders to reach overhead valves. At the same time, convert Danger Zones to Safety Zones. Equip every overhead valve wheel in your plant with Babbitt Adjustable Sprocket Rims with Chain Guides.

- They simplify pipe layout.
- They fit any size valve wheel.
- They are easy to install and operate.
- They operate any valve from the floor.
- They save time and money.
- The first cost is the only cost (no maintenance).
- They are packed completely assembled (one to a carton), with easy-to-follow instructions.
- A hot-galvanized rust proof chain is available for all sizes.

Babbitt Adjustable Sprocket Rims with Chain Guide are carried in stock by most mill supply houses. Just phone your mill supply salesman or contact us direct.

Babbitt 168-B
STEAM SPECIALTY CO.
8 BABBITT SQUARE, NEW BEDFORD, MASS., U.S.A.

TALK ABOUT REPLACEMENT VALVES...

ONE DeZURIK VALVE REPLACES TWO!

JUST ONE dual-purpose valve instead of two . . . with BETTER efficiency, LESS cost and care . . . that's what DeZurik Eccentric-Action Valves are doing on many balancing services in air-conditioning systems.

FOR PRECISE BALANCING:

The DeZurik Valve throttles precisely, has an adjustable stop-ring which can be set to the exact balanced position.

FOR DRIP-TIGHT SHUT-OFF:

No need to use an extra valve; the same DeZurik Valve can be closed dead-tight with an easy, friction-free partial turn.

FOR RETURN TO SERVICE:

You merely re-open the valve to the original, positive stop position. No resetting, no rebalancing; you're back in business and in accurate balance in a second!

DeZurik Valves have replaced gate and globe valve-combinations in hundreds of systems, with obvious reductions in valve costs and in maintenance. They operate without lubrication, without chatter or bind, and emphatically without leakage. These easiest-to-operate valves have also eliminated troubles and costs in many other air-conditioning services, including service on chilled water, condenser water and cooling tower shut-off.

READY TO GO!

DeZurik Balancing Valves are drilled and tapped for quick pressure-gage installation.

Made in sizes ½" thru 24"; 2-way, 3-way, 4-way; manual, on-off or positioning actuators.

ASK FOR SPECIAL AIR-CONDITIONING BULLETIN.

DeZURIK CORPORATION
SARTELL, MINNESOTA

CLAIR COAT

A Superior

LAGGING ADHESIVE

Created By St. Clair Rubber Co. for the toughest pipe and duct Lagging applications.

NOTE THESE 10 HIGH SCORING POINTS

FAST SETTING - Sets almost immediately for faster application.

LOW FREEZING POINT - Usable after being frozen solid.

NONFLAMMABLE — With fire retardant dried film.

STRONGEST PERMANENT BOND - Proved by comparative tests.

ONE COAT NEEDED - For sleek, semi-gloss finish.

STEAMPROOF - WATERPROOF
By contractors's tests.

NON TOXIC - VERMIN PROOF
Will not settle in container.

FINE APPEARANCE - EASILY WASHABLE - Provides long lasting protection.

Also New
St. Clair LAP SEALING
ADHESIVE #45007

Featuring

FASTEST APPLICATION - No waiting for open time.

ONLY ONE COAT NEEDED

IMMEDIATE TACK - FAST GRAB with STRONG BOND.

FINE BRUSHING CONSISTENCY

WHITE COLOR - No. 45007

TAN COLOR - No. 4570

PERM RATING of .05

NO LAP FAILURES
Laboratory controlled quality.

REPLACES STAPLING - BANDING

HEAT RESISTANT to 300° F.

HIGH STORAGE STABILITY
Several container sizes available.

Write for literature - prices - samples, of either or both adhesives

ST. CLAIR RUBBER CO.
Empire Bldg.
107 Clifford St. Detroit 26, Mich.

EQUIPMENT DEVELOPMENTS

Continued

Two-Way Radio Has Miniature Control Head

Transistorized unit has dash-mounted control head 2¼ in. deep by 2¾ in. high by 4 5/7 in. wide. Basic radio is placed in trunk. Three position switch on control head permits off, on, and standby positions. When switch is on "standby," radio is ready to receive and uses only 0.040 amp from the battery. Available in high band and low band frequencies, 25 to 54 mc. and 130 to 174 mc. Power output up to 100 watts available, depending on frequency used. — *General Electric Co., Communication Products Dept., Lynchburg, Va.*

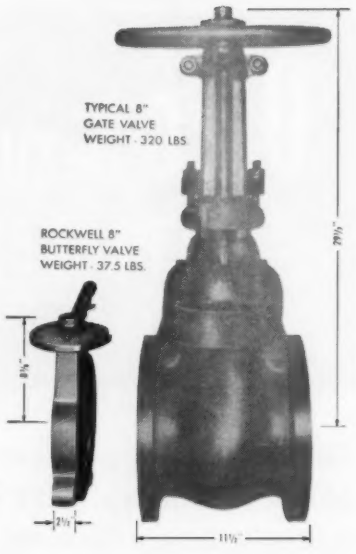
Air Combustion Heaters Have Removable Core Coils

For installation in ductwork breeching, packaged units can be mounted ahead of or behind forced air fans. Structural steel casings and tube supports prevent coil deflection. Guide angles, welded to the frame, also aid in coil removal or insertion. Heavy duty core coils are pitched in the casing for either horizontal or vertical air flow, to provide proper condensate drainage, and to prevent possible freezing. Coils can withstand temperatures to 700 F. Steam or hot water coils are available. Bulletin FD 800 sent on request. — *Buffalo Forge Co., 490 Broadway, Buffalo 5, N. Y.*

Mushroom-Head Roof Ventilator Is Completely Rainproof

Available in 24, 28, 36, and 48 in. sizes, with a variety of fans available on each size. Accessories include wire mesh bird screens and manual or motor operated shutters. Send for additional information. —*Hartzell Propeller Fan Co., P.O. Box 909, Roosevelt Ave., Piqua, Ohio.*

Compare them
✓ for Weight
✓ for Space

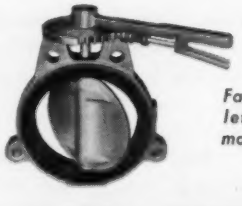


This Rockwell resilient-seated wafer butterfly valve and the large gate valve are both 8" pipe size. Both do the same job. But what a difference in weight, space—and cost.

What does this mean? It means a 60 to 80 per cent reduction in weight in favor of the butterfly valve, depending on size.

As for space, the 8" butterfly valve requires but 8⅜" from center line of pipe for clearance, whereas the gate valve requires over 37" from center line for clearance, when the valve is open.

There are other advantages, too: A quarter turn opens and closes the butterfly valve. The gate valve, however, requires many turns. And operation is easier; maintenance is lower.



Fact-packed Bulletin 590X tells more. Write for it.

W. S. ROCKWELL COMPANY
2700 Eliot St. - Fairfield, Conn.
Made and sold in Europe by
COCKBURNS, Ltd., Glasgow S.W.2, Scotland

NEW DEVELOPMENTS FROM DU PONT:

Traveling assistants for burnout jobs

Here's a new, practical, more effective way to handle refrigeration system burnouts. Not just replacement, not just flushing . . . but *complete* pressure cleaning with Du Pont's new cleaning unit. This new unit utilizes Freon-11*, the most effective selective solvent available for oil, sludge and grease. By completely removing contaminants that can cause new burnouts, you can do the job right the first time . . . eliminate costly, time-consuming call-backs.

Mounted on wheels, this handy assistant is the latest Du Pont effort to make your servicing job easier and more effective. And when it's time to recharge the system, you'll find Du Pont's improved lightweight "Zephyr" cylinder makes the job easier. Take a "Zephyr" on your next burnout . . . or any other job. You can't go wrong.

Leading air conditioning and refrigeration wholesalers who sell "Freon" refrigerants can probably rent you one of the new Du Pont units now. But if you'd like to build your own, write to: Du Pont Co., N-2420HA, "Freon" Products Division, Wilmington 98, Delaware. Ask for Bulletin FD-1.

FREON® *premium quality* ***REFRIGERANTS***

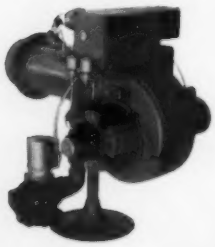
DU PONT

BETTER THINGS FOR BETTER LIVING . . . *THROUGH CHEMISTRY*

**FREON and F- followed by numerals are Du Pont's registered trademarks for its fluorocarbon refrigerants.*

All New
Webster
DUAL FUEL
CYCLONETIC*
Burner

Superior



in any

Configuration

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WEBSTER ENGINEERING
TULSA 9, OKLAHOMA
MR
a division of
Midland-Ross Corporation

EQUIPMENT DEVELOPMENTS

Continued

Air-Cooled Remote Compressors Feature Compact Size

Vertical discharge units for light commercial air conditioning. Model rated at 30,000 Btu per hr at 95 F measures 16⅞ in. wide by 25 13/32 in. high by 44½ in. long. Other models to be available. Narrow width achieved by a side-intake, top-discharge pattern of handling condenser air. Condenser coil has a 5.53 sq ft, three-row design with ½ in. tubes with 13 rippled-surface aluminum fins per in. Includes liquid refrigerant sub-cooler and liquid sight with moisture indicator. Fan is a 16 in. propeller type, powered by a 1/6 hp, 1050 rpm motor. — *The Payne Co., 855 Anaheim-Puente Rd., La Puente, Calif.*

Flow Rate Controllers Are Self-Contained

For purge and other flow control and indication applications. Series "8800" units include a rotameter mounted on a needle-valve-operated flow controller. Controller has an internal diaphragm assembly designed to give a constant pressure differential for any valve setting. Has no external piping. Capacities range from 0.01 gph (water) or 0.2 scfm (air) to 12 gph or 48 scfm. Pressure ratings: 250 psig for brass models; 500 psig for stainless steel models. Other pressures available. Bulletin No. 148 sent on request. — *Brooks Instrument Co., Inc., Hatfield, Pa.*

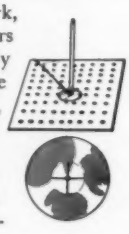
Strap Clamp for Plastic Pipe Has Double Lock Design

Made in four sizes, one of which will fit all pipe ranging from ½ to 2 in. Two locks share band tension. "Lox-On" clamps are made entirely of 18-8 stainless steel, including the screw. Send for sample and information. — *Ideal Corp., 435 Liberty Ave., Brooklyn 7, N. Y.*

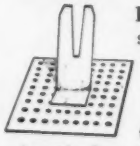
SAVE TIME—
SAVE MONEY
with these dependable
INSULATION HANGERS

GEMCO
Spindle Hangers and
W-A Self-Locking Washers

Ideal for insulation work, Gemco Spindle Hangers are easily and quickly installed... with positive adhesion to concrete, brick or metal. W-A Self-Locking Washers pressed over spindles with minimum effort and lock insulation securely in place.



GEMCO Pronged Hangers



Designed especially for supporting various types of block insulation. Easily applied for positive adhesion. Prongs (available in various lengths from 1 3/16" to 6⅞") bend over to hold insulation firmly in place.

TUFF-WELD Nylon Hangers

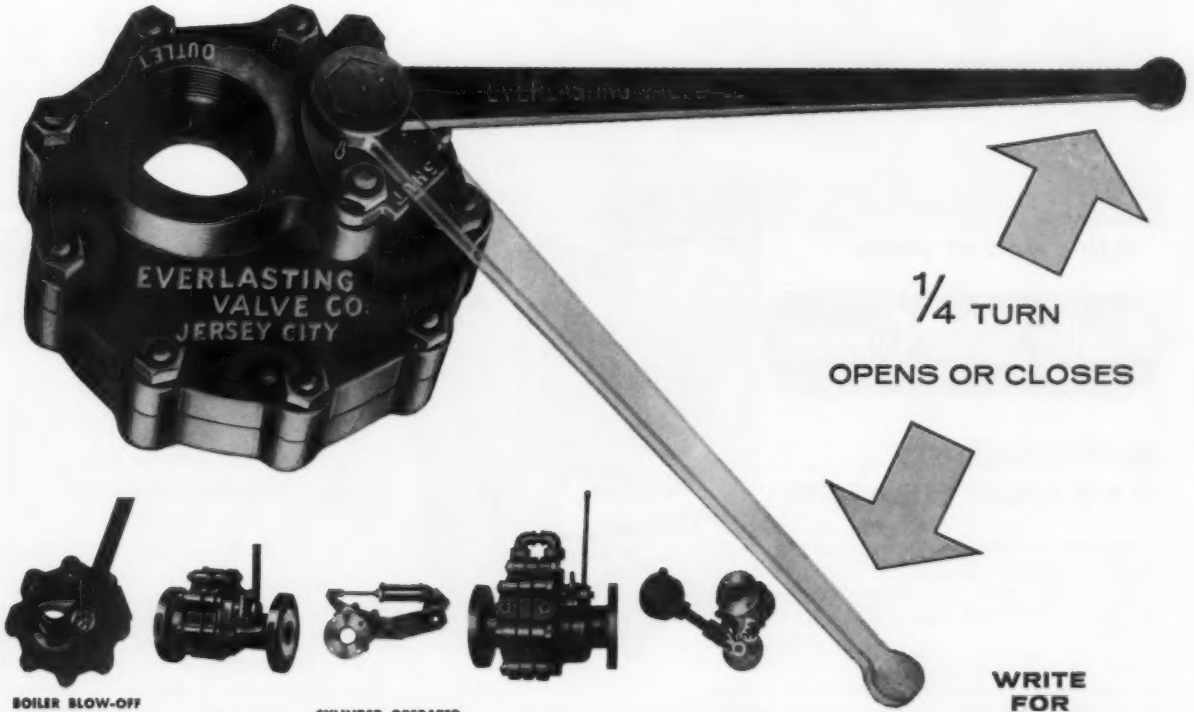
Two-piece hangers... with bases of tough, mold nylon and spindles of metal. Made especially for smooth surfaces. Spindles snapped into bases as needed; reduces inventory, storage space, freight costs. W-A Self-locking washers hold insulation securely in place.

TUFF-BOND Quik-Set Adhesive (for smooth or slightly irregular surfaces) and Improved General Purpose Adhesive (for rougher surfaces) assure permanent adhesion of hangers when used as directed. Write or wire for details and specifications.

GOODLOE E. MOORE
INCORPORATED
DANVILLE 28, ILLINOIS

When you need fast, easy opening and closing with a leak-proof seal and straight-through flow with minimum pressure drop specify

EVERLASTING



BOILER BLOW-OFF Quick acting, also handwheel operated "Y" and angle types. For pressures up to 600 psi.

GENERAL SERVICE Where drop-tight seal and full flow is essential.

CYLINDER OPERATED Can be remotely controlled, electrically or manually.

STEAM JACKETED Assures free flow of viscous materials.

WEIGHT-OPERATED For automatic drains or emergency shut off.

WRITE FOR BULLETIN

EV-409

EVERLASTING VALVE COMPANY, 61 FISK STREET, JERSEY CITY 5, N.J.

CUTTING POWER!

Holes From Floor to Ceiling With One Setup of Longyear "330" Drill!

For more facts on application of Longyear drills and diamond bits, write Department 5B.

A midwest contractor had to make two 6 x 7 foot openings through a 13-inch thick concrete wall. Their air hammer stopped every time it hit reinforcing. Finally they tried a Longyear "330" drill and 6-inch diamond bits. With one setup of the "330" they cut a line of holes from floor to ceiling, ¾-inch reinforcing and all! No scaffolding needed.

Longyear

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76 S. Eighth Street, Minneapolis 2, Minnesota
Phone: FEderal 9-7631

ADV 1758

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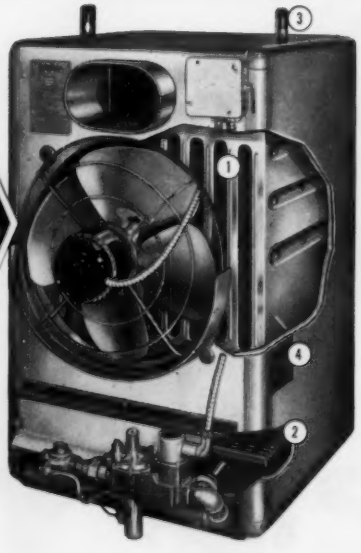
DIVISION OF WORTHINGTON



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1. **RESISTAL*** aluminized steel heat exchanger resists corrosion many times longer than ordinary steel. Designed for maximum heat transfer with no direct flame impingement. All-welded construction for quiet operation, long, trouble-free life.
2. Cast-iron drilled-port burners for "clean", service-free operation.
3. Convenient triple-duty lifting and hanging brackets.
4. Automatic fan and limit control plus summer switch.

Complete size range from 25,000 to 225,000 BTU output. AGA and CGA approved for all gases. Shipped assembled, pre-wired, and test-fired.

Write for details today!

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2000 West Oklahoma Ave., Milwaukee, Wis.
1024 Westminster Ave., Alhambra, Calif.

*TM

MC-99

EQUIPMENT DEVELOPMENTS

Continued

Three-Way Solenoid Valve For Service to 500 Psi

Miniature brass unit handles differential pressures from 0 to 200 psi or up to 500 psi for special applications in hydraulic and pneumatic service. "BM-300" series available in normally-closed, normally-open, directional, and free-venting versions. Measures 1 3/16 in. in diameter by 7/8 in. deep by 3 47/64 in. high. Handles liquids and gases at temperatures ranging from −45 to 150 F. Special models available for media temperatures of −60 to 350 F. Will operate in any position. Operating time is 8 to 12 millisec. Has packless construction. — *Allied Controls Co., Inc., 2 E. End Ave., New York 21, N. Y.*

Hand Tube Benders Available In Sizes from 3/16 to ½ In.

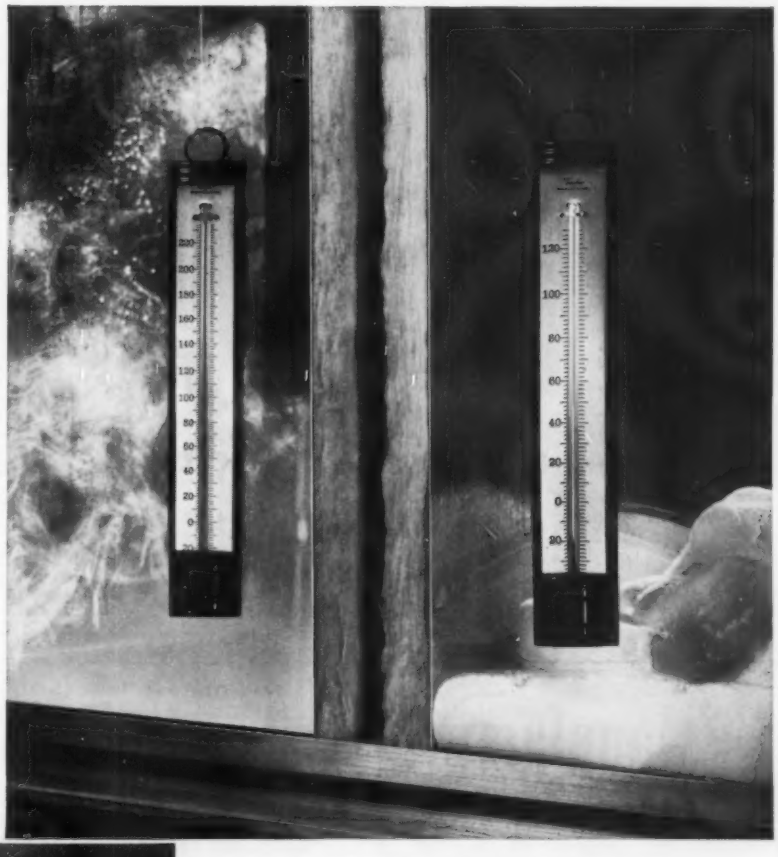
Six sizes for use with soft or hard copper, aluminum, and certain sizes of stainless steel and brass tubing will accommodate tubing of 3/16, ¼, 5/16, ⅜, 7/16, and ½ in. OD. Forming shoes and rolls made of steel. Tools can be removed at any point in the bend. Calibration marks on the forming rolls of the benders are graduated in 45 deg angles to facilitate bends of any angle up to 180 deg at a precise point. — *The Ridge Tool Co., Elyria, Ohio.*

Butterfly Air Valves Have Integral Electric Motors

Valve shaft operates directly from a sealed, lubricated electric power unit. High and low flow positions are set by movement of limit switches. Can be installed in any position, and is available in 1 through 6 in. pipe sizes. Commonly used for low pressure process and combustion air applications at pressures up to 5 psi. — *The North American Manufacturing Co., 4455 E. 71st St., Cleveland 5, Ohio.*

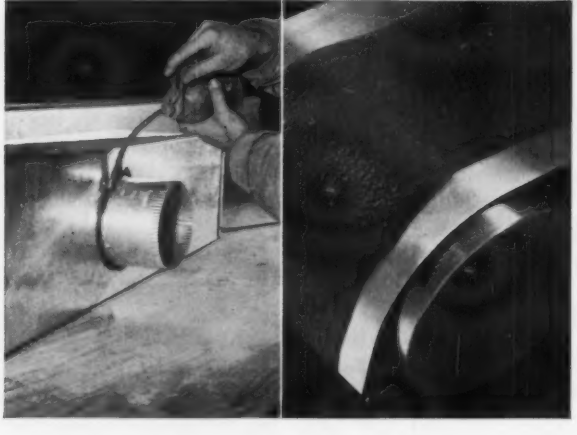
3M Brand Adhesives and Sealers . . .

Insulation Bonds and Duct Seals that HOLD



Even in temperature extremes . . . Insulation Adhesive 1128 HOLDS. Heat as high as 250° F. and temperatures as low as −20° F. can't weaken the bond. It holds fibrous glass insulation firmly on metal ducts and buildings. Highly resistant to moisture, 1128 also helps keep insulation dry when used to bond foil to foil where insulation facings lap.

Insulation Adhesive 1128 can be brushed or sprayed to provide both instant grip and long open time needed for positioning the insulation.



Even in high velocity systems . . . Duct Sealer 800 HOLDS. This sealer is so tough and flexible that a dry film ⅛" thick will withstand bending over a six-inch mandrel at −65° F. Resistant to vibration, it flexes with duct expansion and contraction, won't flow out of seams under pressure even at 180° F. Furthermore, the airtight seal resists water, oil and ageing. Duct Sealer 800 goes on with brush, flow gun or putty knife and sets up so firmly at joints that duct work actually *gains* structural strength.

For more information, see Sweet's Catalog. For free literature about the complete family of 3M Adhesives, Coatings and Sealers for the building industry, see your 3M distributor or write on your company letterhead to: AC&S Division, Dept. SBHX-81, 900 Bush Avenue, St. Paul 6, Minnesota.

ADHESIVES, COATINGS AND SEALERS DIVISION

MINNESOTA MINING AND MANUFACTURING COMPANY

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EQUIPMENT DEVELOPMENTS

Continued

Sound Level Meter Features Wide Frequency Range

Designed to meet the new S1.4—1961 ASA standard. Model "412" operates over a frequency range of 5 cps to 30 KC. A ceramic microphone allows unit to be used in temperatures ranging from 0 to 170 F. A built-in electro-acoustic calibrator insures consistant accurate readings at all times. Operates on two batteries plus a single bias cell. Circuitry includes seven transistors. Has a sound level range of 24 to 150 db. Measures 6¾ by 4⅛ by 11 in.; weighs just over 6 lb. Information sent on request. — *H. H. Scott, Inc., Instrument Div., 111 Powdermill Rd., Maynard, Mass.*

Plug Valve for Water, Oil, Gas, and Air Service

Non-freezing and non-galling unit features "Teflon" seal rings and Buna N rubber 0-rings. Leak proof service at pressures to 125 psi. Made of cast brass. Flow way is round and full nominal pipe size in each size. Unit is self-adjusting and automatically compensates for wear. Solid tee head rotates 360 deg. May be used for temperatures up to 250 F and with "Vitron" 0-rings, up to 400 F. Available in ¾ in. size with larger sizes to be available. Information sent on request. — *Hays Manufacturing Co., General Products Div., 801 W. 12th St., Erie, Pa.*

Heat-Reflecting Coatings For Window Applications

Liquid plastic coatings reflect heat and glare and absorb ultra violet light. Applied by brush, roller, or spray, coatings are permanent and can be washed without being removed. Send for literature. — *Professional Products Research Co., New Buffalo, Mich.*

EQUIPMENT DEVELOPMENTS

Continued

Pressure and Differential Pressure Switches for 0.25 to 16 In. WG Service

Electric switches signal pressures and differential pressures in pneumatic and hydraulic systems and process streams. Units operate by means of a spring-biased diaphragm. Cannot be damaged by overpressures up to their rated capacity of 250 psi. Differential pressure action completely independent of absolute working pressure. Aluminum units are approximately 2 by 3 in., feature vibration resistance, and have been tested at frequencies up to 2000 cycles per sec. — *Pall Corp., Glen Cove, N.Y.*

Air Tube Burners For Air Duct Installation

Air-stream atmospheric-type burners recommended for air heating applications having maximum ambient air temperatures up to 750 F. Standard atmospheric mixer uses gas at any pressure to 15 in. water gage. Gas volume is controlled by a single valve in the gas line which may be manual or automatic. Recommended maximum air velocities are 3000 fpm in air make-up systems and 3500 fpm in oven heaters. Capacities available to 400,000 Btu per hr per 12 in. burner section. Used in conjunction with variable ratio-mixers, a turndown range of 25:1 is attainable. Available in a variety of sections including straights, T's and crosses. Send for bulletin H-10. — *Eclipse Fuel Engineering Co., Combustion Div., Rockford, Ill.*

Differential Pressure Transmitter Extracts Square Root in Flow Measurement

Features a liquid filled, diaphragm-sealed primary unit designed for hydraulic overrange protection to full static pressure of 1500 psi applied to either of the pressure ports. Static pressure compensation is built into the primary force beam assembly. An arrangement of cantilever springs is used to extract the square root from a flow measurement. Provides a standard 3-15 psi output. Available in either an indicating or blind form, with accuracy of ½ percent over a continuously adjustable range interval of 20 to 250 in. water gage (differential pressure). Indicating units have a 11¾ in. long circular scale. — *Taylor Instrument Cos.*, 95 *Ames St., Rochester* 1, *N.Y.*

Tired of residential heating bids with pennies of profit?

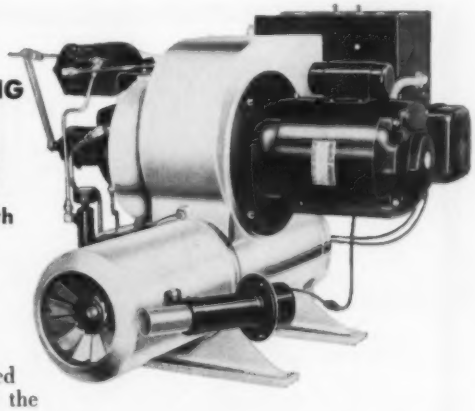
NOW LOOK TO MONEY-MAKING COMMERCIAL JOBS with

HEV-E-OIL BURNERS

Simple as residential installations — with FULL PROFIT and LESS COMPETITION

Home building off, profits down? This year plan to diversify and get part of the huge apartment, commercial and industrial market. HEV-E-OIL Burners are designed to burn inexpensive, heavy oils with all the know-how built in at the factory. This precision engineered unit can be your best salesman.

Each unit is a complete package, ready and as easy to install as any home burner. HEV-E-OIL Burners are factory assembled, fire tested, completely wired. Automatic electronic controls are connected, tested and mounted on the burner. Simple, fast installation saves dollars in time and labor — gives you the FULL PROFIT you deserve . . . with far less competition!



- **Complete range of sizes: 5 to 150 gph.**
- **Only commercial burner to apply the principle of low pressure air atomization of heavy oils *inside the burner nozzle.***
- **All combustion air furnished by the burner.**
- **Meets all code standards; Underwriters' Laboratory approved.**
- **Sold and serviced throughout the world.**

Be the first to get this Plus Profit business in your market. Write Dept. E-81 for complete details and a nation-wide listing of HEV-E-OIL installations. It will give you an idea of where to prospect for Bigger Profits this year.

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For year 'round comfort automation at a reasonable price, the Chatleff Vectrole Valve, Switching Element and Thermostat give you a complete comfort control system at a tremendous saving.

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CHATLEFF CONTROLS INC.

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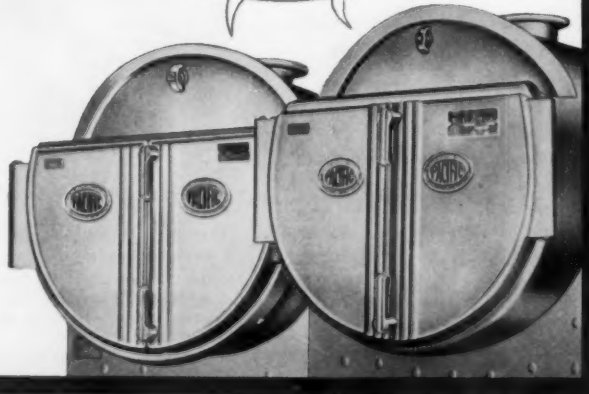
Who's the specialist in large steel heating boilers?

PACIFIC!



For nearly 50 years, Pacific has specialized in big boiler design . . . big boiler construction. Thousands of Pacific boilers have been successfully installed all over the world. With Pacific you get the largest line of low pressure steel heating boilers. The widest experience, too. Pacific men are boiler experts. There's a Pacific representative in your area. Call him for your next boiler.

PACIFIC STEEL BOILER DIVISION

Division of Crane Co., Johnstown, Pennsylvania

AT THE HEART OF HOME AND INDUSTRY

CRANE

VALVES AND PIPING • ELECTRONIC CONTROLS
PLUMBING • HEATING • AIR CONDITIONING

EQUIPMENT DEVELOPMENTS

Continued

Dry Air System For Compressed Air

Chills (40 F or lower), dries, cleans, and forces air or gases into compressor intakes. Removes cold water before compression, increasing air volume and eliminating oil-water sludge and water vapor corrosion. Air has greater weight per stroke. Prevents vibrations and pulsating noises. Can be used in all single or multi-stage compressors, from 350 cfm up. Over 45 percent air volume can be obtained at no increase in compressor hp. — *Air Systems Div., Lynch Corp., Anderson, Ind.*

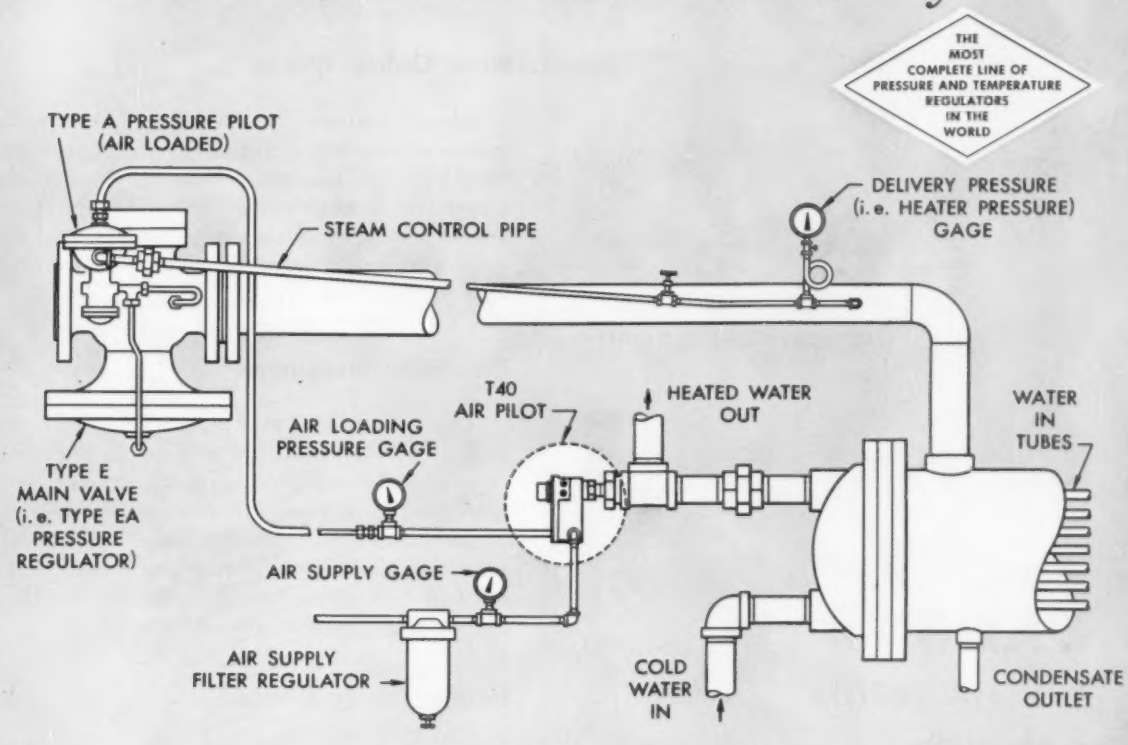
Plastic Caps and Sleeves Protect Threaded Shafts

Molded plastic protective caps and sleeves protect threaded and machined shafts, drill pipe, and other products. Made of polyethylene, they provide a seal against dust and moisture and protect against impact damage during storage, process, or transit. Can be made to practically any depth and in a variety of shapes and configurations. Available in many colors as well as translucent white. Send for bulletin. — *Caplugs Div., Protective Closures Co., Inc.*, 2207 *Elmwood Ave., Buffalo* 23, *N. Y.*

Valve Removes Moisture From Compressed Air Lines

Eliminates water and oil condensation from compressed air lines without causing pressure drop. "Moisture Minder" can be attached to existing systems without cutting lines. Will not balance off and bleed air from the system. Uses system pressure to perform function. Threaded to fit standard ¼ in. pipe with other sizes optional. Bulletin sent on request. — *Barger Manufacturing Co.*, 204 *Foshay Tower, Minneapolis* 2, *Minn.*

New Spence Temperature Control System Gives Unusual Control Accuracy


THE MOST COMPLETE LINE OF PRESSURE AND TEMPERATURE REGULATORS IN THE WORLD
TYPE A PRESSURE PILOT (AIR LOADED)
STEAM CONTROL PIPE
DELIVERY PRESSURE (i.e. HEATER PRESSURE) GAGE
T40 AIR PILOT
HEATED WATER OUT
WATER IN TUBES
AIR LOADING PRESSURE GAGE
TYPE E MAIN VALVE (i.e. TYPE EA PRESSURE REGULATOR)
AIR SUPPLY GAGE
AIR SUPPLY FILTER REGULATOR
COLD WATER IN
CONDENSATE OUTLET

TYPE EAT40 AIR-CONTROL TEMPERATURE REGULATOR (Patent Pending)

In a recent installation the new Spence air-control temperature regulating system provided:

- ±5°F control accuracy under wide and instantaneous load swings of 210 to 80 gallons per minute.
- Up to 50% reduction in cost as compared to instrument systems of similar accuracy.

This unique cascade-type control with throttling range adjustment independent of maximum heater pressure was developed to meet today's demand for greater control accuracy.

Additional features of the new Spence Temperature Control System include:

- 200°F wide adjustable temperature range
- Adjustable speed of steam pressure change
- Over and under temperature protection
- Pressure limit control
- Fast response
- Very low air consumption
- Field reversible for heating or cooling

The Spence Type EAT Air Control Temperature System, when properly installed, will tame wide ranging, fast changing loads of instantaneous heaters and modern heat exchangers. The cascade principle plus the use of an extremely fast responding bi-metal temperature sensing element reduce time lags and provide control stability.

Here's how the new Spence system operates:

Quick response is based on a bi-metal temperature sensing element.

Temperature pilot continuously regulates a loading air pressure.

This loading signal, when applied to a pressure regulator to reflect heater temperatures, causes it to adjust the main valve as changes in load require.

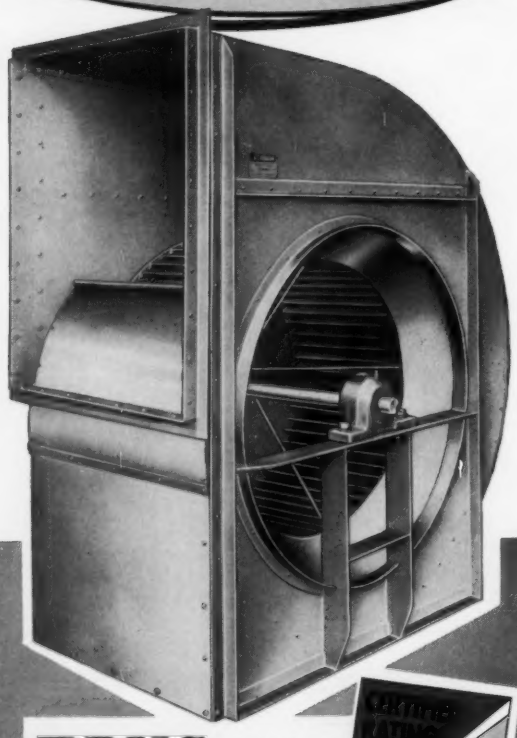
Spence has also developed a new pressure control system based on this same cascade principle. This system has a control accuracy of ½ psi or better from positive pressures through the vacuum range to 30" Hg.

For complete information on these new air controlled temperature and pressure control systems, write for your copy of Bulletin 9.

SPENCE ENGINEERING COMPANY, INC.
Walden 1, New York

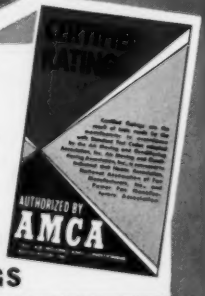
SE-148

Aladdin
AIR HANDLING EQUIPMENT



FANS with built-in quality

- EFFICIENT
- QUIET OPERATING
- CERTIFIED RATINGS



ALADDIN Series 94 Type FC Fans are available in 22 sizes both single and double width. These fans have been designed for the lowest rotational speeds consistant with high efficiency over the widest possible range of operating conditions.

Each fan is ruggedly built... fully equal to the job for which it is designed, and is backed by thirty-five years of know-how in manufacturing all types of air handling equipment.

Write for complete data

ALADDIN HEATING CORPORATION
1111 WEST AVENUE 137 • SAN LEANDRO, CALIFORNIA

RECENT TRADE LITERATURE...

Package Boilers

Sixteen page catalog SB63 provides data on two-drum water tube package boilers, fired by oil or gas. Capacities range from 5000 to 100,000 lb of steam per hour. Four page fold-out shows giant view of boiler. — *Erie City Iron Works*, 1450 *East Ave., Erie, Pa.*

Water Chilling Systems

Bulletin describes 20 absorption water chilling systems with capacities ranging from 50 through 1000 tons. Uses low pressure or waste steam, or high temperature water as energy source. Variety of pass and nozzle arrangements available. Gives physical data, keyed to dimensional line drawings. — *York Corp., Grantley Rd., York, Pa.*

Electrostatic Precipitators

Twelve page bulletin 2128 discusses the air pollution problem and the role of the electrostatic precipitator in solving this problem. Schematic drawing shows operational principles. All major components are labeled. Gives specifications, outlined and illustrated with cutaway artwork. Covers electronic controls and four high voltage rectifiers available. — *American-Standard Industrial Div., Detroit* 32, *Mich.*

Flexible Tubing, Fittings

Four page bulletin No. 29 describes flexible tubing with "Teflon" inner core and bronze wire braid sheath, and field attachable brass fittings. Offers reliable service over a wide range of temperatures, pressures, and corrosive conditions. Applications include service for reciprocating motion, vibration, and flexible connections. Tables give technical data on size, pressure limits, type, etc. — *Atlantic Metal Hose Co., Inc.*, 308 *Dyckman St., New York* 34, *N. Y.*

Electric Motor Valves

Six page bulletin 210 describes "Motortrol" valves for fan-coil units. Two and three-way direct acting units operate in any position. Includes line drawings of typical installation and flow diagrams. A graph shows the flow vs pressure drop. Other drawings, tables, and charts give operating and construction data, dimensions, and an exploded view of the units. — *Erie Manufacturing Co.*, 4000 *S. 13th St., Milwaukee* 21, *Wis.*

DEKORON POLY-COR *Instrument Harness*

used in the air conditioning control system of

UNION CARBIDE BUILDING

Everything about the new Union Carbide building is impressive. For example, the over 4000 thermostats, 4000 valves and related controls — all connected with Dekoron Instrument Tubing — that provide individualized comfort conditioning for maximum business efficiency.

Dekoron Poly-Cor plastic instrument tubing, in bundles and single line (adding up to 600,000 feet of single line tubing), was used in this installation.

Poly-Cor, the modern plastic instrument harness, offers outstanding features, including: all-black polyethylene tubes for higher temperature operation . . . number-coded tubes for faster, easier installation . . . Mylar® vapor barrier. These premium features are standard with Poly-Cor.

Architects: Skidmore, Owings & Merrill
General Contractors: George A. Fuller Co.
Mechanical Contractors: Kerby Saunders, Inc. and Raisler Corp.
Mechanical Engineers: Syska & Hennessy, Inc.
Air Conditioning Controls Contractor: Johnson Service Company

A-5150A

Neat installation shows that Poly-Cor eliminates tube bending problems because it can be strung as easily as electric wiring.

Dekoron® products

quality • research • service

SAMUEL MOORE & COMPANY

DEKORON PRODUCTS DIVISION • **MANTUA, OHIO**

RECENT TRADE LITERATURE
Continued

Heat Exchangers

Twenty-four page catalog No. 601 describes both steam to water and water to water heat exchangers. Shell and tube design utilizes a U-tube, removable type tube bundle. Illustrated with photos and tables. — *Old Dominion Iron & Steel Corp., Belle Isle, Richmond, Va.*

Diaphragm Valve Air Operators

Six page bulletin 134-A provides data on eight types of air operators for firm's diaphragm valves that provide remote and automatic flow control of corrosive and non-corrosive liquids and gases. Sizes available for valves from ½ through 12 in. Sectional drawings, tables of air actuator pressures for various line pressures, and dimensional data are given for air open-spring close, spring open-air close, and air open-air close types of operators. Illustrates and describes travel stops for limiting valve closure, limit stops for limiting valve openings, and positioning devices for throttling service. — *Hills-McCanna Co., 400 Maple Ave., Carpentersville, Ill.*

Steel Boilers

Eight page bulletin No. 549B describes three-pass square-heat type "R" steel boilers available in 12 sizes ranging from 243,000 to 1,350,000 Btu per hr SBI Rating. Units meet all ASME and SBI code requirements. Gives tabulated data on ratings and dimensions. Covers typical specifications and selection data for available heating coils and induced draft fans. — *American-Standard Industrial Div., Detroit 32, Mich.*

Plastic Tubing

Twelve page catalog describes a broad range of tubing for various applications. Tubing is non-toxic and odorless. A chemical resistance table serves as a guide for users. Illustrated with line drawings, tables, and photos. — *Cobon Plastics Corp., 44 Lafayette St., Newark 2, N.J.*

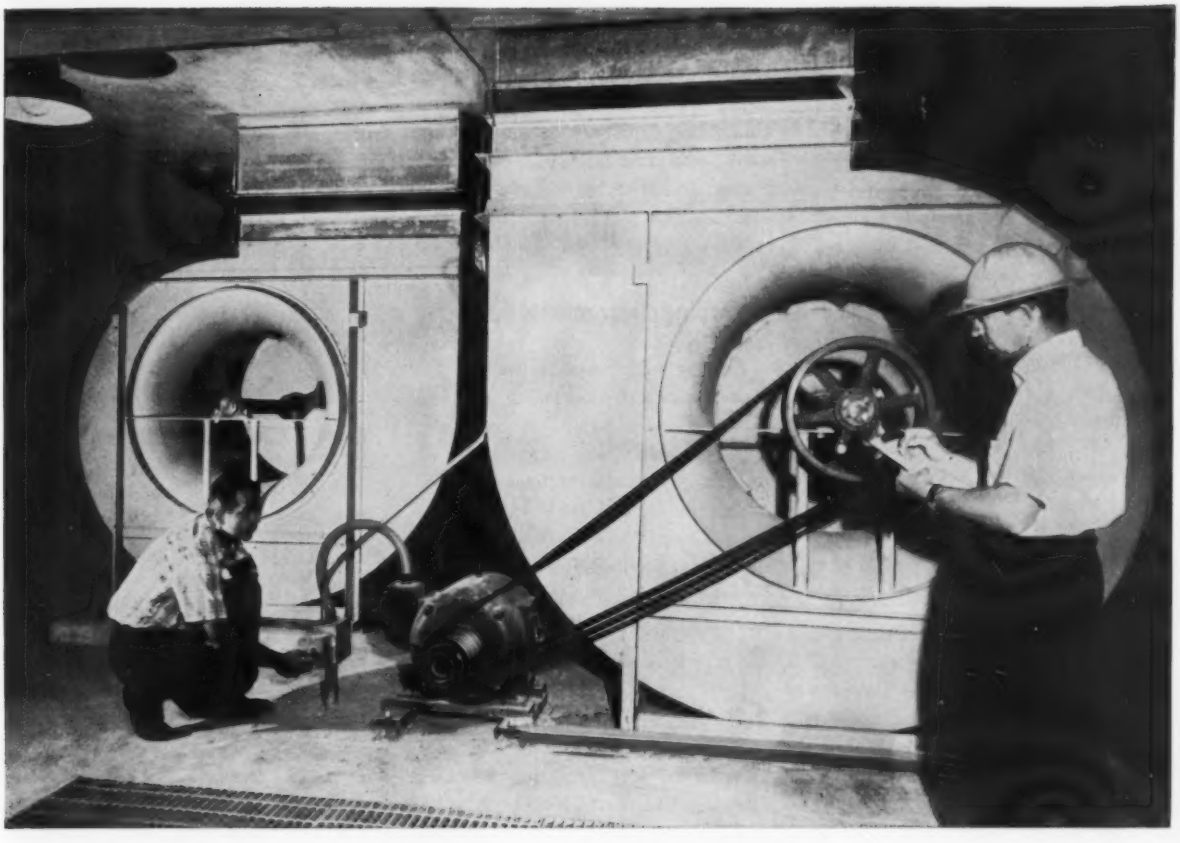
Rubber Seat Butterfly Valves

Four page bulletin 6 covers models from 3 to 144 in. and for pressures from vacuum to 150 psi. Illustrated with photos, line drawings, dimensional drawings, and tables. — *The Henry Pratt Co., 319 W. Van Buren St., Chicago 7, Ill.*

Water Cooling Coils

Brochure provides information on water cooling coils, including facts on tubing, fins, types of return bends, headers, and other data. Includes a table of nominal capacities for rough calculations. — *Astro Products Corp., 1601 W. Edgar Rd., Linden, N.J.*

AFI MEMBER
AIRSAN
Reg. U. S. Pat. Off.
GREASE FILTERS
PERMANENT, CLEANABLE TYPE AG
Made especially for range canopies, galleys, kitchens, ventilation systems.
EXTRA HEAVY CONSTRUCTION
Provides better thermal mass to resist "burn-outs." Offers longer service. Also available in stainless steel enclosing frames.
PRE-ASSEMBLED UNITS for CEILING or Walls
Completely pre-assembled units available . . . just set in place and bolt together. Save time and labor costs. Eliminates complex assembly problems. Available in stainless steel, steel, aluminum.
REDUCE FIRE HAZARD PROBLEMS resulting from grease laden fumes as AIRSAN GREASE FILTERS prevent grease from entering exhaust ducts, protect motors . . . increase working comfort.
Air Filter Corporation
A few distributorships available. Write for details!
Send for FREE Bulletins!
4554-P West Woolworth Ave., Milwaukee 18, Wis.
For Safer kitchens in Hospitals, Industrial Plants, Hotels, etc. Write for Bulletin G505



"Bacteria Tight" *Peerless Electric*® Blowers

135 OF THEM ASSURE CONSTANT VENTILATION AT NATIONAL ANIMAL DISEASE LABORATORY, U.S. DEPARTMENT OF AGRICULTURE, AMES, IOWA

• A constant supply of fresh air and an equal amount of exhaust air are of critical importance at this 14-million-dollar installation. Lack of proper ventilation would seriously undermine the success of any experiment being conducted here. For every group of supply and exhaust fans and blowers, there is stand-by equipment of identical capacity. Blowers are welded "bacteria tight" and duct work is sealed to prevent any contamination from one research section to another. Entire installation is capable of delivering 1,042,375 cfm at capacity operation.

ARCHITECTS AND ENGINEERS: Ralph M. Parsons Co., Los Angeles, California
Brooks-Borg, Des Moines, Iowa

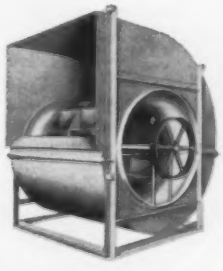
GENERAL CONTRACTOR: Beck-Truckee Co., Dallas, Texas

MECHANICAL CONTRACTOR: Natkin and Company, Omaha, Nebraska

SHEET METAL CONTRACTOR: Iowa Sheet Metal Contractors, Inc.,
Des Moines, Iowa

Manufactured and sold in the western states by Master Fan Corporation, H. K. Porter Company, Inc., 1323 Channing Street, Los Angeles 21, California. NOW AVAILABLE —Centrifugal Blowers to 132" wheel diameter, Turbo Blowers to 55 S. P., Tube and Vaneaxial Blowers and Industrial Fans to 104" wheel diameter.

Investigate Peerless Air Moving Equipment Today! Write to Peerless Electric Division, H. K. Porter Company, Inc., 1409 West Market Street, Warren, Ohio.



PORTER **PEERLESS ELECTRIC DIVISION**
H. K. PORTER COMPANY, INC.

Member—Air Moving and Conditioning Association, Inc.

RECENT TRADE LITERATURE
Continued

Hydraulic Control Pilot

Two page catalog sheet describes "No. 811" hydraulic control pilot for controlling diaphragm valves. Spring-loaded, diaphragm-actuated pilot operates on water or light oil. Responds to variations in pressure as small as 1 psi in the flow line to readjust the main regulator for throttling of the steam, gas, or liquid flow. Controlled pressure ranges are 3 to 15 psi, and 10 to 40 psi. A minimum actuating pressure of 30 psi is required. — *Atlas Valve Co., 280 South St., Newark 5, N. J.*

Vertical Enclosed-Shaft Pumps

Sixteen page bulletin 124-G covers units for sump service and similar applications. Capacities range from 50 to 5000 gpm with heads to 105 ft. Describes a method for determining non-clog pump head and capacities. Includes pump and motor selection tables; preliminary layout dimension data; specifications; and details on controlling devices, optional equipment, and installations. — *Chicago Pump, 622 Diversey Parkway, Chicago 14, Ill.*

Recording Instruments

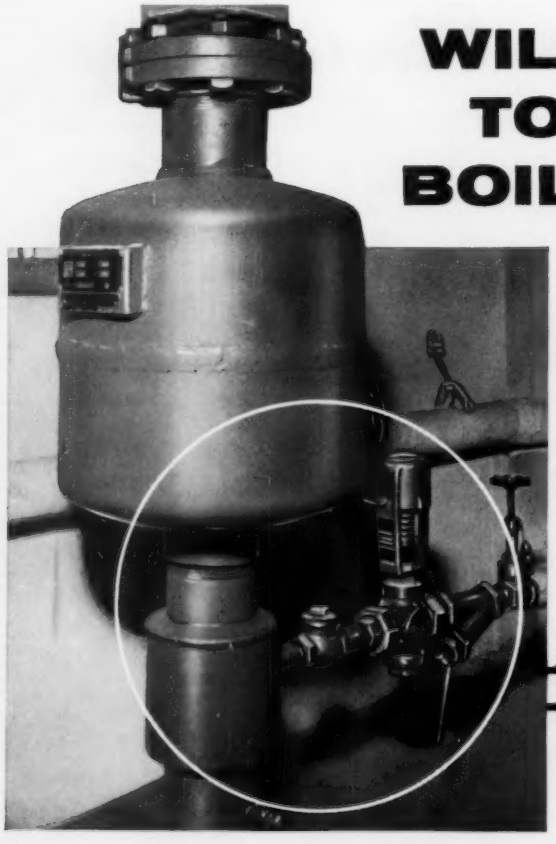
Catalog 625 covers recording and controlling instruments for temperature, pressure, humidity, and other applications. Includes a guide for determining thermal systems and diagrams of typical bulb installations. Gives specifications and selection data. Also includes illustrations of all basic units. — *Weksler Instruments Corp., Freeport, L.I., N.Y.*

Ball Valves

Sixteen page catalog describes "Flo-Ball" valves featuring top entry, double seats, flanges integral with body, and one piece ball and stem. Includes cutaway drawings, exploded views, material charts, pressure-temperature curves, and dimension tables and drawings. Features several series of 150 psi ASA flanged valves, 300 psi ASA flanged valves, 600 psi W.O.G. screwed end bar stack valves, and vacuum to 3000 psi shut-off valves. — *Hydromatics, Inc., 5 Lawrence St., Bloomfield, N.J.*

Compressed Air Aftercoolers

Eight page bulletin 120 describes "Paracoil Type AC" aftercoolers for compressed air and gas applications. A floating type sheet end incorporates weep holes in the retaining ring to forestall mixing of shell and tube side fluids. Capacities range from 30 to 5650 cfm of air. Illustrated with tables, photos, and line drawings. — *Davis Engineering Div., Tube Reducing Corp., P.O. Box 959, Passaic, N.J.*



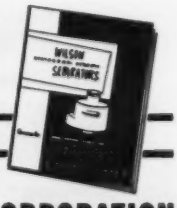
WILSON'S ANSWER TO ECONOMICAL BOILER BLOWDOWN

A Wilson Centrifugal Blowdown Separator is easy to install —requires no maintenance—instantaneously clears steam flash through the large top vent pipe. Water and sludge fall by gravity through bottom drain. No objectional noise.

To reduce temperature of blowdown before entering sewer, Wilson also provides an economical, easy to install *aftercooler*. No maintenance here, either.

(Shown in the circle) Wilson Aftercooler with thermostatic valve for controlling water supply in the drain—extra equipment available from Wilson.

ASK ABOUT the Wilson Centrifugal Blowoff Separator for high pressure hot water relief valve installation.

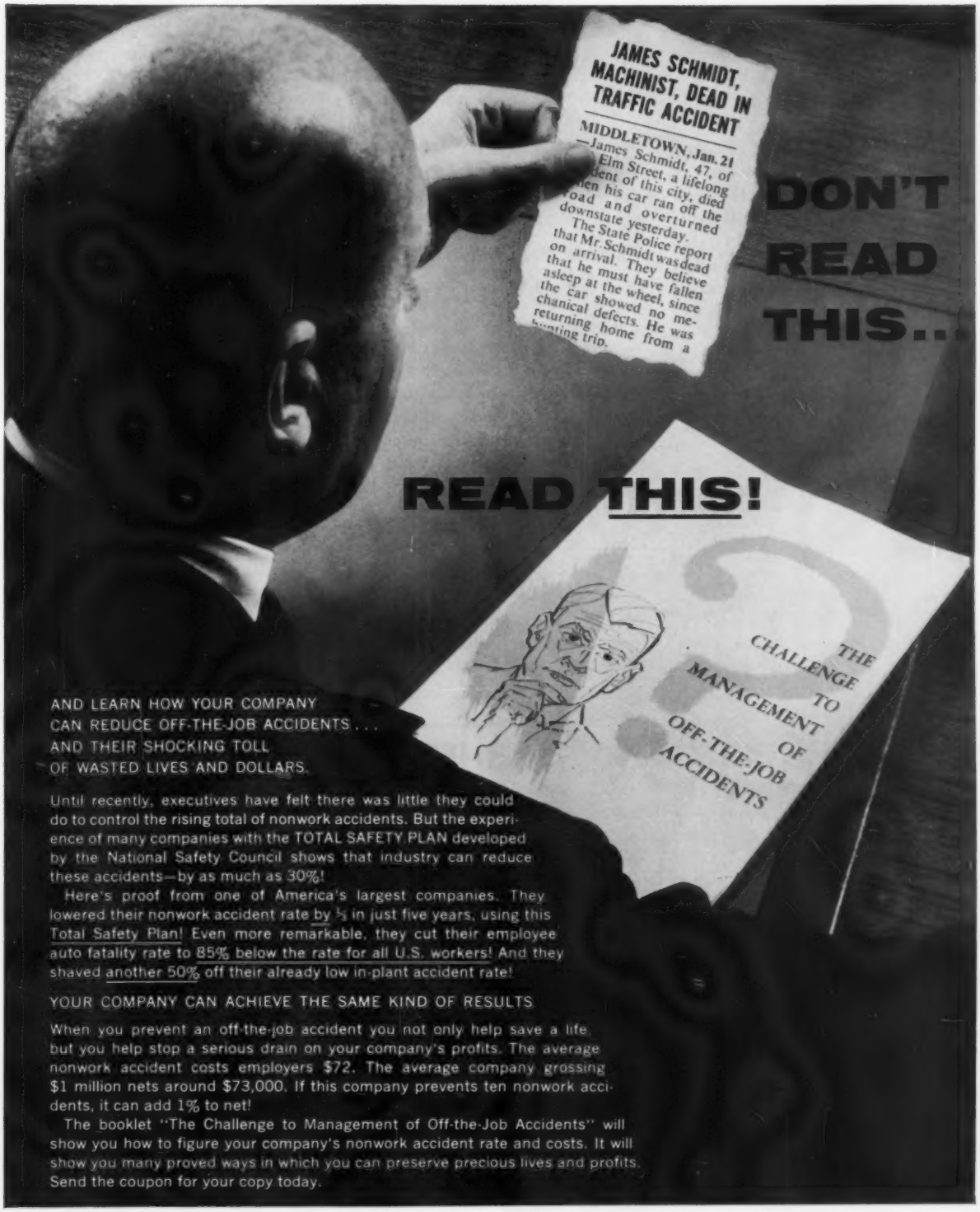


Write for new Bulletin!

Dept. HA-61

WILSON ENGINEERING CORPORATION

6 North Michigan Ave., Chicago 2, Illinois


JAMES SCHMIDT, MACHINIST, DEAD IN TRAFFIC ACCIDENT
MIDDLETOWN, Jan. 21 —James Schmidt, 47, of Elm Street, a lifelong dent of this city, died hen his car ran off the oad and overturned downstate yesterday.
The State Police report that Mr. Schmidt was dead on arrival. They believe that he must have fallen asleep at the wheel, since the car showed no mechanical defects. He was returning home from a hunting trip.
DON'T READ THIS..
READ THIS!
THE CHALLENGE TO MANAGEMENT OF OFF-THE-JOB ACCIDENTS

AND LEARN HOW YOUR COMPANY CAN REDUCE OFF-THE-JOB ACCIDENTS . . . AND THEIR SHOCKING TOLL OF WASTED LIVES AND DOLLARS.

Until recently, executives have felt there was little they could do to control the rising total of nonwork accidents. But the experience of many companies with the TOTAL SAFETY PLAN developed by the National Safety Council shows that industry can reduce these accidents—by as much as 30%!

Here's proof from one of America's largest companies. They lowered their nonwork accident rate by ⅓ in just five years, using this Total Safety Plan! Even more remarkable, they cut their employee auto fatality rate to 85% below the rate for all U.S. workers! And they shaved another 50% off their already low in-plant accident rate!

YOUR COMPANY CAN ACHIEVE THE SAME KIND OF RESULTS

When you prevent an off-the-job accident you not only help save a life but you help stop a serious drain on your company's profits. The average nonwork accident costs employers $72. The average company grossing $1 million nets around $73,000. If this company prevents ten nonwork accidents, it can add 1% to net!

The booklet "The Challenge to Management of Off-the-Job Accidents" will show you how to figure your company's nonwork accident rate and costs. It will show you many proved ways in which you can preserve precious lives and profits. Send the coupon for your copy today.

Published to save lives in cooperation with The Advertising Council and the National Safety Council

SUPPORT YOUR LOCAL SAFETY ORGANIZATION

NATIONAL SAFETY COUNCIL
425 NORTH MICHIGAN AVENUE
CHICAGO 11, ILLINOIS

Please send a copy of "The Challenge to Management of Off-the-Job Accidents." I want to learn how my company can save lives and dollars with your TOTAL SAFETY PLAN.

NAME_____

ADDRESS_____

CITY_____ ZONE_____ STATE_____

RECENT TRADE LITERATURE

Continued

ASME Boiler Code Guide

Wall chart is a quick reference guide to ASME Boiler and Pressure Vessel Code (Section VIII). Illustrates some of the types of pressure vessel construction provided for under the Section, and furnishes direct references to the Code rules that apply to these construction features. For example, circumferential joints are illustrated along with the suggestion to refer to Code rules UW-34 and UW-35 for a full discussion of such joints. — *Missouri Boiler and Tank Co., 23rd and Papin Sts., St. Louis 3, Mo.*

Damper Actuators

Four page catalog explains and shows how to install "Zone-A-Trol" units to provide individual room temperature control of air cooling or heating system. Units may be installed in any shape or size duct. Explains installation application of a dumper damper which is used to control excess air volume and velocity. Illustrated with line drawings. — *Econo Products Co., East Haddam, Conn.*

Flexible Metal Hose

Thirty-two page catalog 600 includes information on how to rate working pressures of flexible metal hose. Discusses non-steady pressures, elevated temperatures, and fitting attachment. Tells how to determine hose length, and explains installation procedures. — *Atlantic Metal Hose Co., 308 Dyckman St., New York 34, N.Y.*

Pressure Control Hook-Ups

Six application guides explain method of improving existing pressure regulating systems. Guides demonstrate ways to provide remote shut-off by two-position electric motor, remote high-low switchover control, remote pressure control, allocation of loads beyond boiler capacity, load limiting pressure regulation, and other applications. Illustrated with diagrams. — *Spence Engineering Co., Inc., Walden 2, N. Y.*

Coils and Fintubes

Six page bulletin 900 gives information on coils, fintubes, and special equipment. Includes a set of fintube engineering standards covering materials, size, surface area, number of fins, and efficiency factors with various fintubes. These include integral continuous resistance welded, high temperature brazed, and extruded fintubes, as well as combination fintubes where various metals are combined with different tube materials. Also describes gas cooling and heating equipment. — *Brown Fintube Co., 300 Huron St., Elyria, Ohio.*

ARCHITECTS AND ENGINEERS ARE SPECIFYING

Ewing

Gas Operated Automatic

HOT WATER HEATERS

SPACE-SAVING VERTICAL TYPE!

DESIGNED AND ENGINEERED for the INDUSTRIAL-COMMERCIAL USER

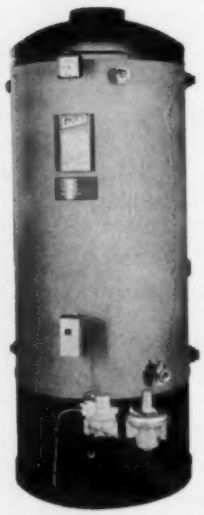
RECOVERY CAPACITIES

Gals. Per Hour 268.8 to 793.8 — Temp. Rise 100 Degrees F.

STORAGE CAPACITY

76 Gals to 217 Gals

4 New Models



HIGHEST QUALITY
1/4 INCH SHELL 3/8 INCH HEAD

AGA AND ASME APPROVED

BURNER ASSEMBLY COMPLETE AND FACTORY INSTALLED

Ewing heaters provide a constant, abundant supply of clear, clean low-cost hot water.

USE ANY TYPE GAS

Write, phone or wire for complete data sheets, specifications and prices.

Ewing MANUFACTURING CO.
2545 NW 10 — P. O. BOX 875
OKLAHOMA CITY, OKLA

RECENT TRADE LITERATURE

Continued

Air Diffusers

Eight page catalog ASL-70 describes straight line units with symmetrical vanes. Includes performance tables on continuous wall-to-wall ceiling mounted or wall mounted diffusers. Installation instructions given in six easy steps. Contains application data and is illustrated with line drawings, photos, tables, and charts. — *Anemostat Corp. of America, 10 E. 39th St., New York 16, N.Y.*

Fan Vibration Monitoring

Four page report V-108 gives case history on the use of continuous-monitoring vibration-sensitive devices in railway tunnel ventilation equipment. Detectors are capable of sensing impending mechanical failure with all types of rotating or reciprocating machinery before widespread damage occurs. — *Robertshaw-Fulton Controls Co., Aeronautical and Instrument Div., Santa Ana Freeway at Euclid Ave., Anaheim, Calif.*

Small Centrifugal Fans

Bulletin GP-100 gives details on line of cast-housed, small volume fans for use in exhausting fumes from chemical laboratories, handling light dust from polishing wheels, or other applications. Units have cast, radial bladed wheels, balanced and mounted directly on the motor shafts. Four sizes and nine capacities are available. — *General Blower Co., Morton Grove, Ill.*

Storage Tank Heaters

Sixteen page catalog No. 602 describes hot water storage tank heaters made of two sections: the storage tank section consisting of a steel, copper-silicon or other special alloy tank; and a removable copper or admiralty U-tube heating element. Units available in both horizontal and vertical models. Illustrated with photos, tables, and line drawings. — *Old Dominion Iron & Steel Corp., Belle Isle, Richmond, Va.*

Centrifugal Fans

Four page catalog 1122 describes industrial airfoil units for heavy duty applications. Direct-connected motors produce capacities from 15,000 to 450,000 cfm. Discusses operating features, construction details, and engineering data. Also explains the airfoil bladed wheel and the optional accessory of inlet vane air spin control. — *Westinghouse Electric Corp., Sturtevant Div., Dept. T-293, Hyde Park, Damon St., Boston 36, Mass.*

20 D-H FLOOR/CEILING-MOUNTED PUBLIC SPACE AIR HANDLERS

CREDITS: ARCHITECT: Charles F. McKirahan, Ft. Lauderdale, Florida. AIR CONDITIONING CONTRACTOR: Josueth Gonzalez, Quito, Ecuador. D-H INTERNATIONAL SALES REPRESENTATIVE: Climate Control International, Inc., Los Angeles

Send for Brochure CSHV 312.01

drayer-hanson

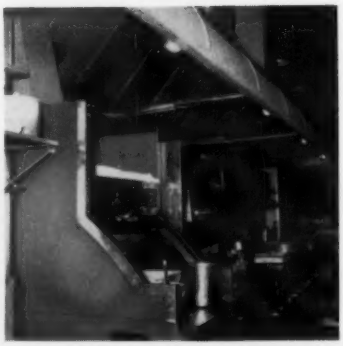
DIVISION OF

HI-PRESS AIR CONDITIONING OF AMERICA, INC.

3301 Medford Street, Los Angeles 63, California

(Cable: Cliconi, Los Angeles)

VORTOX AIR FILTERS



Typical bank of grease Filters in a kitchen range canopy.

SPECIFY TYPE VG VORTOX COMBINATION GREASE FILTER AND FLAME ARRESTER.

Vortox grease filters, like Vortox dust filters, deliver top efficiency at both high and low velocities. They are easily cleaned by regular dishwashing methods and are simple and easy to remove and install.

VORTOX TYPE "VG" Grease Filters are available in 2" thickness and in 4 standard sizes . . . shipped from stock! Other sizes and materials on special order.

Selected territory available for qualified representatives.

AFI MEMBER AIR FILTER INSTITUTE

VORTOX COMPANY

121 South Indian Hill Blvd.
Claremont, California
Los Angeles Area

RECENT TRADE LITERATURE

Continued

School Unit Ventilators

Sixteen page booklet provides data on "60" series for classroom heating and ventilating. Describes features of heating surface, counterflow air and water, damper linkage, drum type dampers, accessible filters, removable motor and fan assembly, 44 blade balanced fan wheels, two speed motor, welded steel framing, and other features. Illustrated with photos and line drawings. — *Schemenauer Manufacturing Co., Holland, Mich.*

Welding Fittings

Thirty-six page catalog provides data on various welding fittings including caps, elbows, flanges, reducers, return bends, stub ends, and tees. A chart is included for each product, listing various construction data. A photo and a dimensional line drawing is also included for each product. — *Weldbend Tubular Products Co., 3601 W. 53rd St., Chicago 32, Ill.*

Roof Top Air Conditioners

Twenty-four page brochure describes year 'round air conditioning units for roof mounting on single story buildings. Can be used to heat and cool, heat only, or cool only. Unit is installed directly above the area to be conditioned; also available for various connection combinations to external ducts. Illustrated with photos, line drawings, and tables. — *Melchior, Armstrong, Desseau, Inc., Ridgefield, N.J.*

Silver Alloy Brazing

Data file gives procedures for torch brazing with "Silverloy" low temperature silver brazing alloys. Describes six steps for strong, leakproof joints: joint design, preparation for brazing, fluxing and assembling, heating and making the braze, cooling the work and flux removal, and inspection. — *Engelhard Industries, Inc., 75 Austin St., Newark 2, N.J.*

Roof Ventilators

Sixteen page bulletin A-112E describes four types of propeller fan roof ventilators: two vertical discharge units; a mushroom head unit; and a reversible unit that can be converted from exhaust to intake by switch action. Also includes information on penthouses and stack caps. Illustrated with photos, tables, and dimensional drawings. — *Hartzell Propeller Fan Co., P.O. Box 909, Roosevelt Ave., Piqua, Ohio.*

RECENT TRADE LITERATURE

Continued

Handling Methyl Chloride

Sixteen page bulletin covers the storage, transfer, and measurement of methyl chloride and other liquefied gases. Topics include: handling and supporting cylinders; emergency handling of leaking containers; pressure in a container; transfer by heat and by compressor. Illustrated with line drawings. — *Ansul Chemical Co., Chemical Products Div., Marinette, Wis.*

Molecular Sieve Filter Driers

Six page bulletin 276-A gives data on eight types of unit for drying, filtering, and acid removal in air conditioning systems. Photos and cross sectional drawings are provided for each type. Also gives a performance table listing connection sizes, pressure drop, psi, and drying capacity. — *American-Standard Controls Div., 5900 Trumbull Ave., Detroit 8, Mich.*

Heat Exchangers

Bulletin describes "Platecoil" equipment consisting of two metal sheets embossed and welded together to form passages for heating or cooling media. Can be engineered and built to requirements of shape, size, materials of contruction, and heating or cooling capacity. — *Tranter Manufacturing, Inc., Lansing 9, Mich.*

Clamps, Couplings, Joints

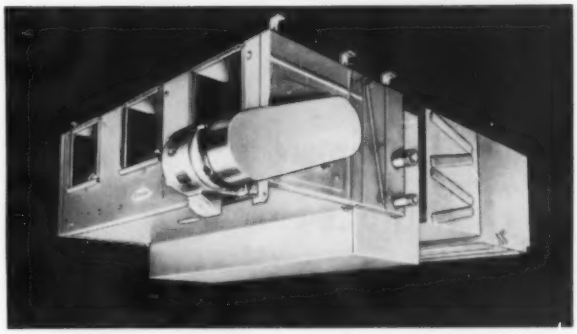
Brochures cover units for both maintenance and original equipment application. Gives information on pipe joints that do not require threading or grooving, a hose clamp, band clamps, pipe repair clamps, identification clamps, and threaded joints for small diameter tubing. — *Marman Div., Aeroquip Corp., 11214 Exposition Blvd., Los Angeles 64, Calif.*

Registers and Grilles

Sixty page catalog 61 provides data on full line of wall grilles, cold air faces, registers, and grilles. Illustrated with photos, dimensional drawings, and tables. — *The Independent Register Co., 3747 E. 93rd St., Cleveland 5, Ohio.*

CARRIER HEATING AND VENTILATING UNITS

offer wide selection flexibility with substantial heating economy



Carrier 46P, Q, RV Units have heating capacities ranging from 47,000 to 2,990,000 Btu per hour, air handling capacities from 1500 to 32,000 cfm.

Widely used for heating and ventilating all types of large industrial or commercial buildings. Ideally suited for heating "make-up" air to prevent infiltration of cold air around windows and doors. By maintaining positive building pressures, they effect appreciable savings in operating costs. Other advantages:

❶ A complete choice of steam or hot water coils, available for each of seven basic unit sizes, makes it practical and economical to match heating capacity to individual job needs.

❷ Fan sections, complete with V-belt drives and multiple discharge outlets, permit a range of air handling capacities and discharge arrangements.

❸ Fan assemblies, designed to run well below their critical speeds, operate smoothly and quietly —either as free discharge units or with ducts.

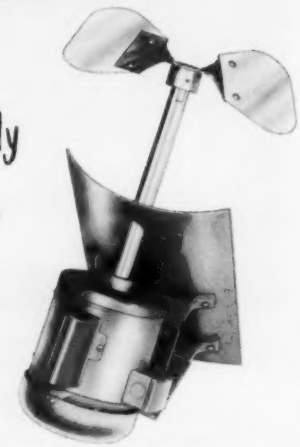
❹ Carrier units also provide for extreme flexibility in the selection of controls and matching accessories. Base units arrive at job site factory-assembled, the accessories individually crated, for easy handling and installation.

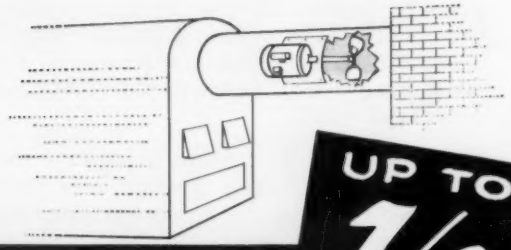
For complete information, write for Catalog 46P,Q,RVIII, or call your Carrier representative listed in the Classified Directory under "Heaters—Unit." Other products in the complete Carrier heating line include Unit Heaters for steam and hot water; Gas-Fired Unit Heaters and Gas-Fired Duct Furnaces. Carrier Air Conditioning Company, Syracuse 1, N.Y.

Carrier Air Conditioning Company

Walker SHUR-FLO INDUSTRIAL DRAFT INDUCER

Installs Simply In Minutes, With No Interruption In Service!





UP TO 1/2 CUT COSTS

★ Walker saves up to one-half on draft inducer costs. The Shur-Flo Saddle-Mounting model is extremely economical to buy, install and operate.

★ Eliminates draft variables due to wind, atmosphere and inadequate chimney construction.

★ Produces a substantial increase in chimney capacity.

The Walker Shur-Flo Draft Inducer brings to industry a new means of obtaining combustion efficiency.

See our representative or direct inquiries to . . .

Walker MANUFACTURING & SALES CORP.
1705 PENN • ST. JOSEPH, MO.

WE HEAR THAT . . .

LENNOX INDUSTRIES INC. has won a Certificate of Merit from the Producers' Council, Inc. for its Engineering Handbook that was entered in the joint PC-Consulting Engineers Council literature contest. The award was won in the classification of "literature offering technical information relating specifically to a product or products of a single manufacturer."

BENJAMIN & FLACK, consulting engineers, have appointed Benjamin Silberstein, P. E., as chief mechanical engineer. The firm has main offices in New York City.

Effective December 31, 1961, *AMERICAN-STANDARD INDUSTRIAL DIV.* will no longer market *JOHN J. NESBITT* school products. The arrangement under which American Standard promoted and sold this equipment is being terminated by mutual agreement to allow both firms to pursue individual growth objectives.

A branch and warehouse serving central and eastern New York state has been opened by *THE RAWLPLUG CO., INC.*, at 207 Irving Ave., Syracuse 3, N. Y.

Harold H. Hollingsworth has been named sheet metal superintendent and William S. Wilson, Jr. has been named piping superintendent in the Pittsburgh branch of *LIMBACH CO.'s* Mechanical Department. Limbach is a nationwide mechanical contractor.

B. P. Morabito received the annual Wolverine-ASHRAE Diamond Key Award, sponsored by the American Society of Heating, Refrigerating & Air-Conditioning Engineers at the society's 68th annual meeting. Mr. Morabito received the award for his paper entitled, "How Higher Cooling Coil Differentials Effect System Economies," that appeared in the August, 1960 issue of the ASHRAE Journal. Mr. Morabito is associated with *CARRIER CORP.*

CERRO CORP. has acquired *VIKING COPPER TUBE CO.* of Cleveland, a fabricator of thin-wall copper tube for the air conditioning and control industries. Viking is now a subsidiary of Cerro.

CRANE LTD. (Canada) has acquired *SOUTHERN INDUSTRIES LTD.*, Marieville, Quebec, manufacturers of pumps, pressure systems, circulators, and other products.

WE HEAR THAT

Continued

Herbert E. Ziel, associate in charge of air conditioning and ventilating for *ALBERT KAHN ASSOCIATED ARCHITECTS AND ENGINEERS, INC.*, was elected chairman of the Air Conditioning in Industry Committee of the American Society of Heating, Refrigerating & Air-Conditioning Engineers at their recent national convention in Denver, Colo. Mr. Ziel has written articles for Heating, Piping & Air Conditioning.

THE RUBEROID CO. has opened its new general offices at 733 Third Ave., New York, N. Y. The firm has leased the entire 11th floor (20,000 sq ft) of a 24 story office building on a long-term basis.

WALLACE HERDLEIN & ASSOCIATES INC. has been incorporated to design, engineer, and manufacture air handling systems and other products. With headquarters at 208 S. LaSalle, Chicago, Ill., the firm is now sub-contracting its manufacturing operations, but is looking at several plant sites in the mid-west for a permanent location.

A patent (No. 2,981,474) has been issued to *THERMOTANK INC.* for its sliding bar mechanism for choking temporary excessive high pressures in double duct systems.

YORK DIV., BORG-WARNER CORP. is moving its room air conditioner production from Decatur, Ill., to the new *NORGE DIV.* plant at Fort Smith, Ark.

PACKLESS METAL HOSE, INC. has moved its general offices and manufacturing facilities to York, Pa.

ADEL PRODUCTS DIV., GENERAL METALS CORP., has acquired the "Pathon" line of hydraulic valves from *PATHON MANUFACTURING CO.* The purchase included complete engineering data, inventory, and tooling required to manufacture these products.

An agreement has been made by the *FRICK CO.* and *WILSON BROS.* calling for Frick Co.'s *PENNSYLVANIA-BRADFORD APPLIANCE DIV.* to purchase substantially all the assets of *LAWSON MANUFACTURING CO.* and its *HOFFMAN WATER HEATER DIV.* in Louisville, Ky.

...in GRID

It's the material that makes the difference

for a...

✓ CORROSION-FREE
✓ TROUBLE-FREE
✓ LOW-MAINTENANCE

HEATING SYSTEM . . . GRID Cast Iron Construction resists corrosion externally from acid fumes and internally from electrolysis. No leaking from rotted cores.

GRID one-piece cast iron heating sections and headers are leakproof on steam pressures up to 250 p.s.i. 450° temperature. Smaller steam lines cost less.

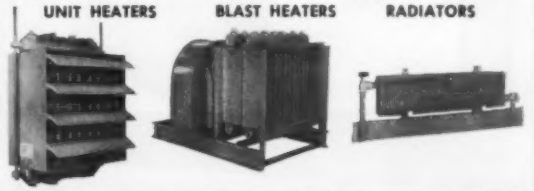
GRID heating sections with widely spaced fins cast integral with steam chambers are easy to clean — Will not "mat" on air intake side.

GRID design develops low outlet temperatures and with proper fan volumes, delivers warm, comfortable air to floor — No wasted heat at ceiling.

ask ASK for complete information on GRID Cast Iron Steam Heat Transfer Surface . . . write for catalog #956.

INSTALL GRID CAST IRON

UNIT HEATERS BLAST HEATERS RADIATORS



D. J. MURRAY MANUFACTURING CO.
Manufacturers Since 1883 • WAUSAU, WISCONSIN
REPRESENTATIVES IN ALL PRINCIPAL CITIES

WE HEAR THAT

Continued

Merger of a Cincinnati research and development firm, *RAD, INC.*, with *COMMERCIAL FILTERS CORP.* of Melrose, Mass. has been recommended by directors of both firms. The proposed merger now requires stockholder approval. *RAD* will continue to operate in Cincinnati as a division of Commercial Filters.

CRESCENT PLASTICS, INC. has completed construction of a 29,000 sq ft expansion program that includes enclosed warehousing facilities.

ALLIED CHEMICAL CORP. has opened a plant in Elizabeth, N. J. to produce "Genetron." The plant's capacity exceeds 10,000 tons per year of the fluorinated hydrocarbon refrigerants and aerosol propellants.

Hot water boilers with a three year manufacturer's guarantee against damage from "thermal shock" are now being offered by the *BOILER ENGINEERING AND SUPPLY CO., CONTINENTAL BOILER DIV.* The guarantee provides for repair of equipment, and under certain conditions, complete replacement of the boiler.

A "butt-fusion" technique for field joining of high density polyethylene pipe has been developed by the *PHILLIPS CHEMICAL CO.* The pipe ends (which can be cut with a common hand saw) are squared off and placed in line-up clamps so that they face each other. An aluminum plate, heated to about 400 F, is inserted between the two ends. After about 30 sec of exposure to the heated plate, the pipe ends soften. When this happens, the heated plate is removed, and the two molten pipe ends are gently pressed together. After about 20 sec cooling time the joint is completed.

GENERAL AUTOMATION MANUFACTURING, INC. is a new company formed by the merger of Portomag, Inc. and its Di-Cor division with General Automation Co. The new firm, with plant and offices at 1200 E. Maple Rd., Troy, Mich., produces diamond drilling bits and machines, and other equipment.

A film titled, "What Kind of Pipe Should I Buy" has been released by *ALLIED CHEMICAL CORP.'s PLASTIC DIV.* The 14 min film presents the story of polyethylene pipe as a conversation between a consumer and a pipe authority.

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The practical limits of perfection in d-c welding, as such limitations are assessed today, are attained in Miller Gold Star welders with their exclusive, completely sealed, semi-metallic rectifiers.

Top illustration — the SR — comes in four basic models of from 200 to 600 amperes, with duplex hook-ups rated to 1200 amperes.

The space-saving SRH is only 30¼" high and is used widely for stacking and paralleling where room is at a premium. This model is offered in 200, 300 and 400 amperes.

Complete particulars on the above welders will be sent promptly upon request. Also available is a frank and interesting pamphlet titled "Rectifiers for Welding," which gives a question and answer treatment to the established facts of welder rectifiers.

●

MILLER ELECTRIC MANUFACTURING COMPANY
APPLETON, WISCONSIN

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Canadian Liquid Air Co., Ltd., Montreal

WE HEAR THAT

Continued

RUSSELL, BURDSALL & WARD BOLT AND NUT CO. has expanded its facilities to provide complete mold making, pigmenting, and precision injection molding of "Delrin," "Nylon," high impact styrene, polypropylene, "Lexan," and other thermoplastic compounds.

Complete warehouse facilities have been built in Dallas, Tex. by *GAFFERS & SATTLER*. The address is 154 Howell St., Trinity Industrial Park.

ALUMINUM CO. OF AMERICA has successfully demonstrated how to join aluminum tube in multi-row coils used in air conditioners. The test was held at the research laboratories of the *SELAS CORP. OF AMERICA*.

E. H. Smoker has been nominated for president of the *AMERICAN GAS ASSOCIATION*. Elections will be held Oct. 4 at AGA's 43rd annual convention in Dallas, Tex.

JOSAM MANUFACTURING CO. has acquired the *WADE MANUFACTURING CO.* Wade will be operated as a division of Josam.

ANEMOSTAT CORP. has moved into a 165,000 sq ft plant in Scranton, Pa. Research, development, and production programs will be carried out in the new facility.

CERRO SALES CORP. has taken over the sale of all metals produced by *CERRO CORP.'s* mines in South America.

John A. Hill, president of *AIR REDUCTION CO., INC.*, and Andrew Kaul, chairman of the board of *SPEER CARBON CO.* have entered an agreement whereby Air Reduction would acquire Speer in an exchange of stock. The agreement is awaiting approval of Air Reduction's board of directors and Speer's stockholders.

Two color sound films have been produced by *CORNING GLASS WORKS* to explain the reason why glass drainline is effective in the disposal of corrosive wastes and to show installation procedures.

DIAMOND POWER SPECIALTY CORP. has purchased three companies in Southhampton, England, from Whitfield Industrial Developments Ltd., of London.

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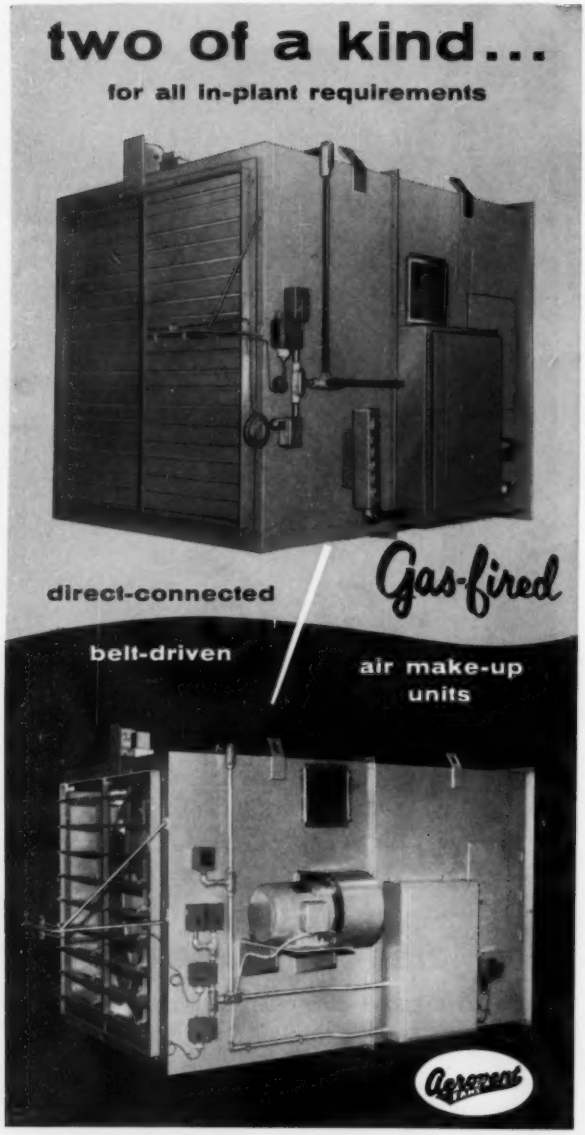

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WE HEAR THAT

Continued

The *HOLLY-GENERAL DIV., THE SIEGLER CORP.* has acquired additional property adjacent to its plant in Pasadena, Calif. for the purpose of adding 100,000 sq ft of factory space to its present facility.

John I. Yellott, director of the *YELLOTT SOLAR ENERGY LABORATORY,* will participate on behalf of the United States in the United Nations Conference on New Sources of Energy in Rome, August 14 to 28, and the NATO Symposium on the Utilization of Solar Energy, in Athens, September 4 to 18.

The *UNITED STATES PUBLIC HEALTH SERVICE TAFT SANITARY ENGINEERING CENTER* and the *NEW YORK STATE AIR POLLUTION CONTROL BOARD* have both purchased a complete copy of the Bay Area Pollution Control District's Library Index of 16,850 reference cards. These cross-indexed cards cover over 8000 technical reports and other publications, offering an excellent research source on air pollution.

Robert F. McCormick of the *AUTOMATIC SWITCH CO.* has been elected president of *FLUID CONTROLS INSTITUTE, INC.* First vice president elected is Eric A. Bianchi, *MASON-NEILAN, DIV. OF WORTHINGTON CORP.* Samuel J. Reid, *BARNES & JONES, INC.,* is second vice president, and Paul K. Rogers, Jr., *SKINNER ELECTRIC VALVE DIV., SKINNER PRECISION INDUSTRIES, INC.,* is treasurer. Corporate secretary elected is Howard J. MacDonald, *MINNEAPOLIS-HONEYWELL REGULATOR CO., VALVE DIV.* E. R. Rath of the FCI is executive secretary.

Carl F. Speich, research engineer at *BATTELLE MEMORIAL INSTITUTE,* was awarded the Willis H. Carrier Award at the annual meeting of the American Society of Heating, Refrigerating & Air-Conditioning Engineers. The award, sponsored by the *CARRIER CORP.,* is given annually for the best technical paper presented at an annual meeting of the society by an associate member under 30 years of age. Mr. Speich co-authored his paper with Abbott Putnam, also of Battelle. Titled "Acoustical Systems Determine Oil Burner Pulsations and Their Amplitudes," the paper is concerned with the theoretical basis for one type of undesirable noise which may result from combustion in oil burners.

MEETINGS & CONVENTIONS

JULY 31-*AUGUST* 11 — *Tufts University Summer Institute for Technical Writers and Publishers.* Tufts University, Medford, Mass. Information: Mrs. Florence N. Trefethen, assistant director, 8 N. Hall, Tufts University, Medford 55, Mass.

AUGUST 14-18 — *UA International Apprentice Contest.* Purdue University, Lafayette, Ind. Information: United Association of Journeymen & Apprentices of the Plumbing & Pipefitting Industry of the United States and Canada, United Association Building, 901 Massachusetts Ave., N.W., Washington 1, D.C.

AUGUST 21-31 — *International Exhibition of New Sources of Energy.* To be held concurrently with the *United Nations Conference on New Sources of Energy.* Circo Massimo, Rome. Information: Rassegna Internazional Elettronica e Nucleare, Vis della Scrofa, 14, Rome. (cable address: ROMATOM) Please mark correspondence: International Exhibition of New Sources of Energy.

SEPT. 12-14 — *Southeastern Maintenance and Engineering Show.* War Memorial Coliseum, Greensboro, N.C. Information: John Harden Associates, P.O. Box 3173, Greensboro, N.C.

SEPT. 18-20 — *Standards Engineers Society* 10*th Annual Meeting.* Hotel Sherman, Chicago, Ill. Information: Standards Engineers Society, 170 Livingston Ave., New Providence, N. J.

SEPT. 25-28 — *American Welding Society Fall Meeting.* Adolphus Hotel, Dallas, Tex. Information: Information Center, American Welding Society, 33 W. 39th St., New York 18, N.Y.

SEPT. 27-*OCT.* 4 — *The Institute of Heating and Ventilating Engineers, International Conference on Heating, Ventilating and Air Conditioning.* London, England. Information: F. L. Rossetti, secretary, Con-

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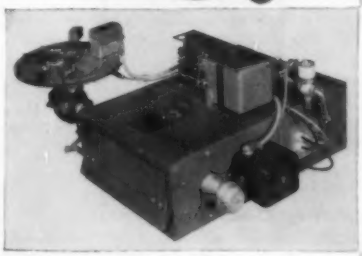

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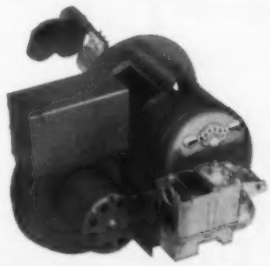

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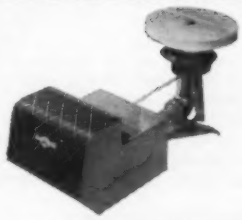

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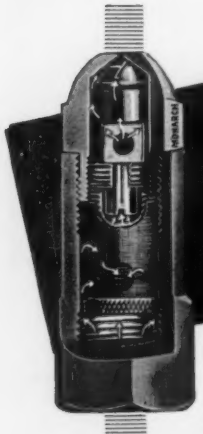

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MEETINGS & CONVENTIONS

Continued

ference Coordination and Management Committee, 49, Cadogan Sq., London, S.W. 1.

OCT. 1-4 — *43rd Annual Meeting, American Gas Association.* Registration, Dallas Municipal Auditorium; various sessions at the Statler Hilton, Sheraton-Dallas, Adolphus, and Baker hotels, Dallas, Tex. Information: American Gas Association, 420 Lexington Ave., New York 17, N. Y.

OCT. 2-3 — *Engineers' Council for Professional Development 29th Annual Meeting.* Sheraton Seelbach Hotel, Louisville, Ky. Information: Engineers' Council for Professional Development, 29 W. 39th St., New York 18, N. Y.

OCT. 7-10 — *Western Building Industries Exposition.* Great Western Exhibit Center, Los Angeles, Calif. Information: Western Building Industries Exposition, 2216 S. Hill St., Los Angeles 7, Calif.

OCT. 9-11 — *Technical Committee on Cooling Water Problems, North Central Regional Meeting of National Association of Corrosion Engineers.* Chase Park Plaza Hotel, St. Louis, Mo. Information: Otto H. Fenner, Monsanto Chemical Co., 1700 S. 2nd St., St. Louis 4, Mo.

OCT. 16-17 — *International Conference on Air Ionization.* Franklin Institute, Philadelphia, Pa. Information: American Institute of Medical Climatology, 1618 Allengrove St., Philadelphia 24, Pa.

OCT. 16-20 — *National Safety Council Annual Convention.* Industrial sessions will be held in various hotels, Chicago, Ill. Information: National Safety Council, 425 N. Michigan Ave., Chicago, Ill.

OCT. 23-26 — 1961 *Conference and Exhibition of the South Central Region of the National Association of Corrosion Engineers.* Shamrock Hilton Hotel, Houston, Tex. Information: National Association of Corrosion Engineers, 1061 M & M Building, Houston 2, Tex.

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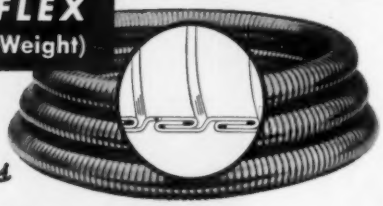

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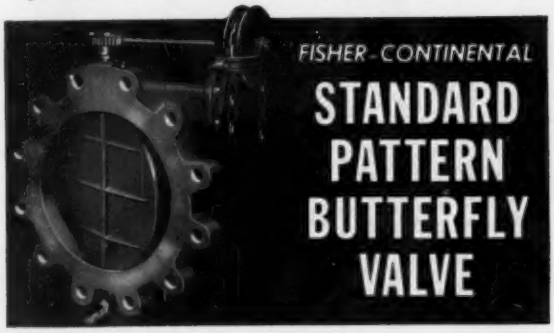

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MEETINGS & CONVENTIONS

Continued

OCT. 29-31 — *Fall Meeting of the Fluid Controls Institute, Inc.* Hotel Hershey, Hershey, Pa. Information: Fluid Controls Institute, Inc., P.O. Box 667, Pompano Beach, Fla.

NOV. 12-15 — *Air-Conditioning and Refrigeration Institute Annual Meeting.* The Homestead, Hot Springs, Va. Information: Air-Conditioning and Refrigeration Institute, 1346 Connecticut Ave., N.W., Washington 6, D.C.

NOV. 13-16 — *National Warm Air Heating and Air Conditioning Association Annual Convention.* La Salle Hotel, Chicago, Ill. Information: NWAHACA, 640 Engineers Bldg., Cleveland 14, Ohio.

NOV. 13-17 — *American Public Health Association, 89th Annual Meeting, Air Pollution Session.* Cobo Hall, Detroit, Mich. Information: American Public Health Association, 1790 Broadway, New York 19, N.Y.

NOV. 26-*DEC.* 1 — *The American Society of Mechanical Engineers Winter Annual Meeting.* Statler Hilton Hotel, New York, N.Y. Information: L. S. Dennegar, director of public relations, American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N.Y.

1962

JAN. 22-25 — *Plant Engineering and Maintenance Show.* Convention Hall, Philadelphia, Pa. Information: Clapp and Poliak, Inc., 341 Madison Ave., New York 17, N.Y.

FEB. 12-15 — *Air Conditioning and Refrigeration Industry 12th Exposition.* Great Western Exhibit Center, Los Angeles, Calif. Information: George E. Mills, Air-Conditioning and Refrigeration Institute, 1346 Connecticut Ave., N.W., Washington 6, D.C.

MEETINGS & CONVENTIONS

Continued

MARCH 19-21 — *Second National Electric Comfort Heating Exposition, National Electrical Manufacturers Association.* Sherman Hotel, Chicago, Ill. Information: National Electrical Manufacturers Association, 155 E. 44th St., New York 17, N.Y.

MARCH 19-23 — *National Association of Corrosion Engineers Annual Conference and* 1962 *Corrosion Show.* Kansas City Auditorium and Muehlebach Hotel, Kansas City, Mo. Information: National Association of Corrosion Engineers, 1061 M & M Building, Houston 2, Tex.

APRIL 25-29 — *Western Space Age Industries and Engineering Exposition.* Cow Palace, San Francisco, Calif. Information: Lykke-Wilkin & Associates, 681 Market St., San Francisco 5, Calif.

MAY 8-11 — *Mechanical Contractors Association of America 73rd Annual Meeting.* Sheraton Hotel, Philadelphia, Pa. Information: Mechanical Contractors Association, 45 Rockefeller Plaza, New York 20, N.Y.

NEW BOOKS & REPORTS...

Mechanical Measurements — Written by Thomas G. Beckwith and N. Lewis Buck of the University of Pittsburgh, this book is an introduction to modern measurement techniques. Subject matter is divided into two parts. Part one deals with fundamentals, and part two deals with the application of these fundamentals. Price, $8.75. — *Addison-Wesley Publishing Co., Inc., Reading, Mass.*

Space Travel Guidebook — Presents a history of man's conquest of flight, with over 100 illustrations and photographs showing the advancement in air power and space exploration. Chapters include the "Evolution of Man's Conquest of the Air," "General Space Travel," "Space Propulsion System," "The Astronaut into Space Travel," "Space Travel Events," "Space Solar System," and others. Price, $4.95. — *W. A. Wilde Co.,* 10 *Huron Dr., Natick, Mass.*

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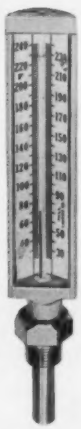

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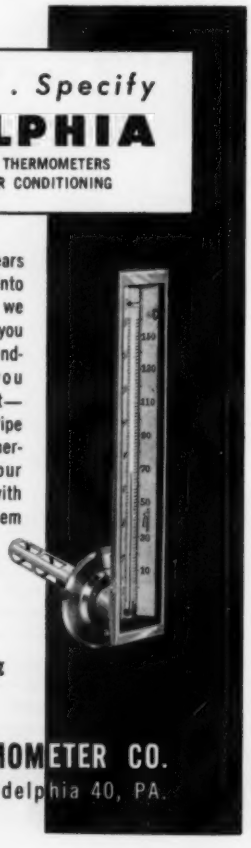

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NEW BOOKS & REPORTS

Continued

The Building and Construction Industry — Lists books found in the Cleveland Public Library on the subjects of heating, piping, air conditioning and other topics concerned with the building and construction industry. Includes periodicals, governmental and institutional surveys and reports. Price, 25 cents if mailed; free if obtained at library. — *Cleveland Public Library, Cleveland* 14, *Ohio.*

Bibliography of Temperature Measurement — Bibliography covers period from January 1953 to June 1960, prepared by the National Bureau of Standards. More than 500 references to the field of temperature measurements are presented in this monograph, which was compiled in cooperation with the AS-2 Committee, Physical Measurement Sensing, of the Society of Automotive Engineers. Price, 15 cents. — *Superintendent of Documents, U.S. Government Printing Office, Washington* 25, *D.C.*

A Study of the Effects of Ionized Air on Behavior — The results of an Air Force study on this subject indicates that ionized air has no effect on human behavior. Groups of 50 male university students were subjected to three tests. The first required a subject to make rapid decisions which involved close attention to detail. The second required relatively infrequent responses to near-threshold stimuli. The third test consisted of check-off lists to reveal the mental attitude of subjects at varying levels of ionization. According to this research, neither the attitudes nor the abilities of the subjects were affected by the ion concentrations. Price, 75 cents. — *Office of Technical Services, Business and Defense Services Administration, U.S. Dept. of Commerce, Washington* 25, *D.C.*

Industrial Heating Units and Devices, HU 1-1961 — Standards from the National Electrical Manufacturers Association covers cartridge, tubular, strip, immersion, and tubular-type water-immersion heaters. Price, 35 cents (minimum order, $1.00). — *National Electrical Manufacturers Association,* 155 *E. 44th St., New York* 17, *N. Y.*

Pipe Friction Manual — The material in this manual is an extension and rearrangement of the pipe friction data contained in The Hydaulic Institute's previous publications. Combines formuli, friction loss moduli, friction factor charts, roughness factor charts, viscosity tables and associated information. Book has 90 pages and a soft cover. Price, $2.00 domestic; $2.40 foreign. — *The Hydraulic Institute,* 122 *E. 42nd St., New York* 17, *N. Y.*

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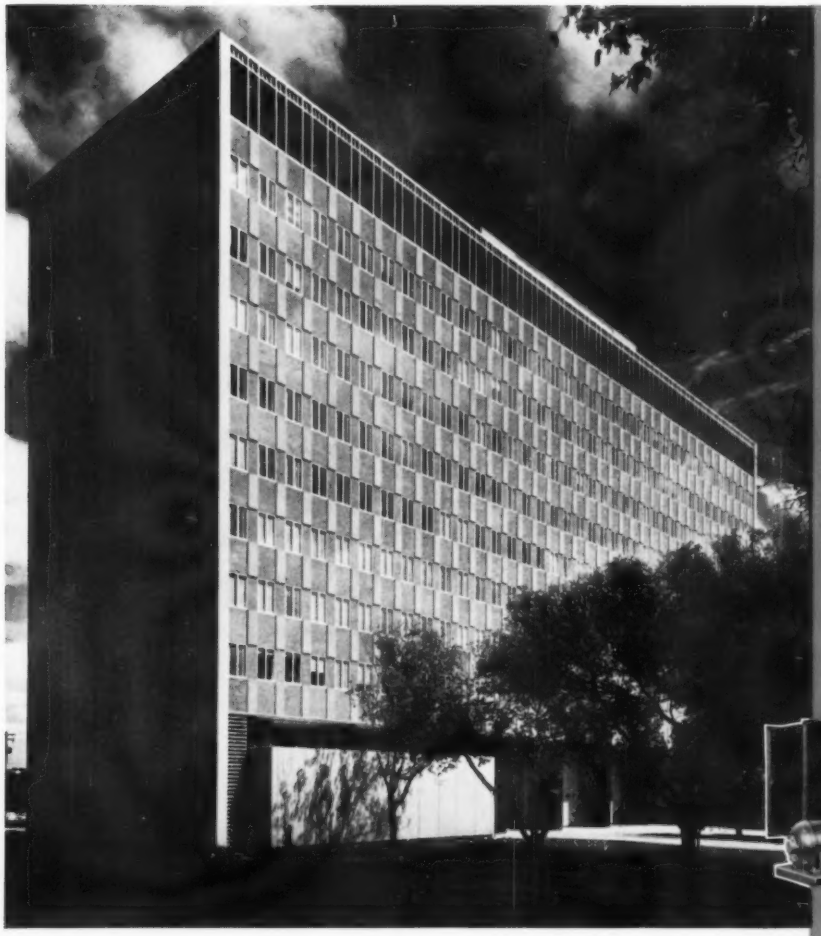

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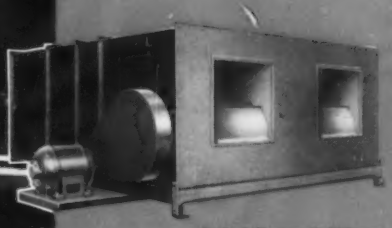

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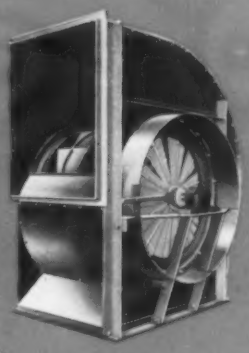

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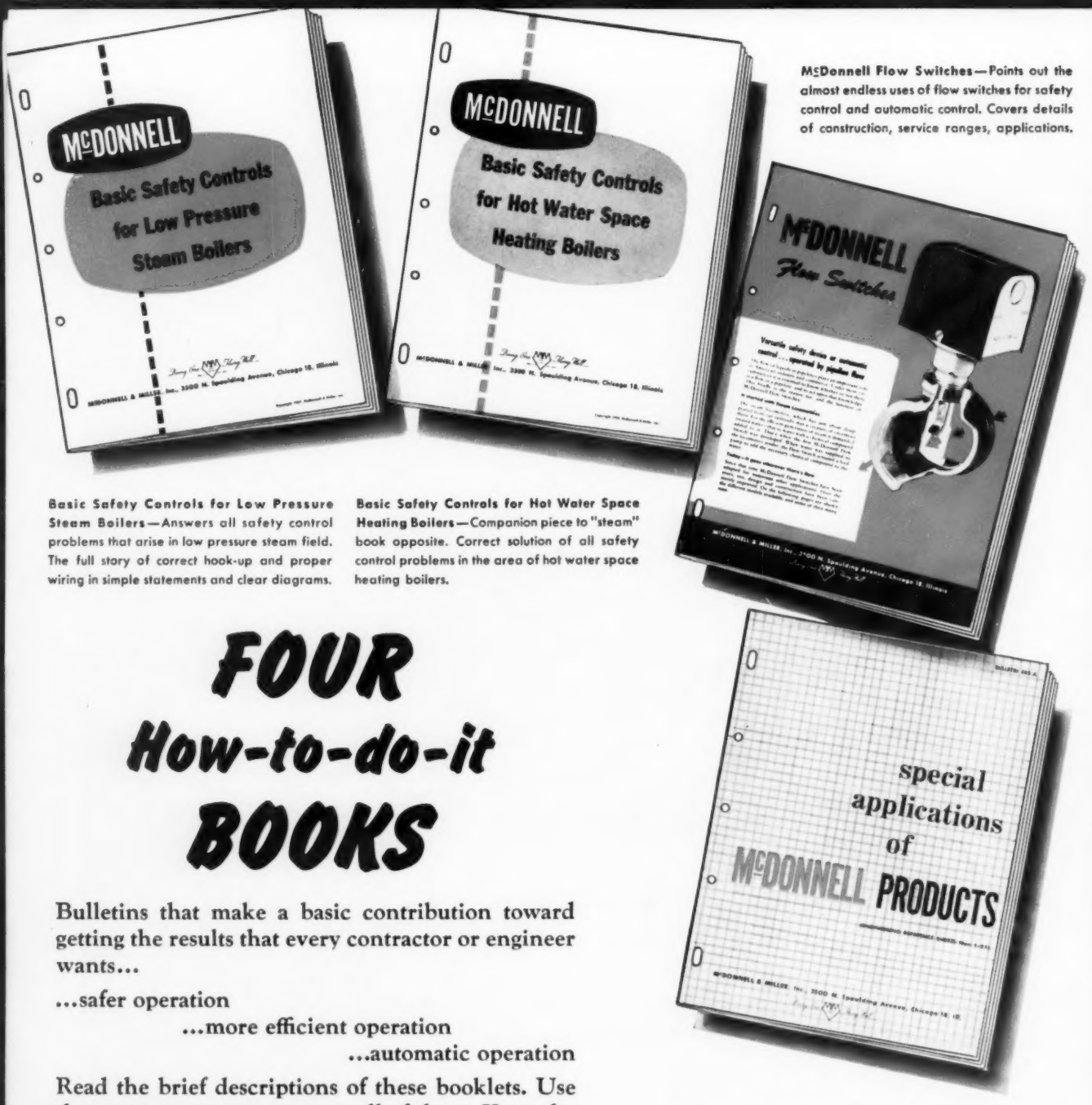

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